THE IRON TRADE REVIEW

VOLUME XXVII. CLEVELAND, O. JUNE 7, 1894. CHICAGO, ILL. NUMBER 23

MAGNOLIA METAL

IN USE BY

Eight Leading Governments.

BEST ANTI-FRICTION METAL FOR

High Speed Engine, Dynamo, Rolling-Mill, Steamship, Railroad, Saw-Mill, Cotton-Mill, Paper-Mill, Woolen-Mill Silk-Mill, Jute-Mill, Rubber-Mill, Sugar-Mill, Flour-Mill, and all Machinery Bearings.

MAGNOLIA METAL CO.,

Owners and Sole Manufacturers,

London Office, 75 Queen Victoria St.
Chicago Office, Traders Building.

74 Cortland Street, NEW YORK.

A Milling Machine or . . . .

a Cutter and Tool Grinder.

If you need either, and where is the shop that doesn't? write

The Cincinnati Milling Machine Co.,

Cincinnati, Ohio.

The prestige and increasing circulation of

THE IRON TRADE REVIEW

make it a valuable adjunct to manufacturers of machine tools, foundry supplies and power equipment.

WALSTON—**COKE**—CONNELLSVILLE.

F. J. & H. R. POOL, Western Reserve Building, CLEVELAND, OHIO.

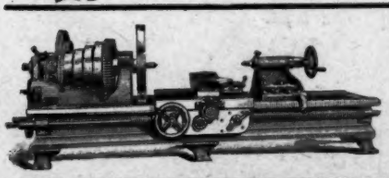
W. C. LYMAN, 49 Michigan Street, **CHICAGO.**

The original inventor of Exhaust Heads for END of Pipe above Roof.

RIVETED EXHAUST PIPE.

Fittings to any Angle and Radius.

LIGHT! STRONG! CHEAP!



HILL, CLARKE & CO.

MACHINERY.

14 South Canal St., CHICAGO.

GAS, GASOLINE OR NATURAL GAS ENGINES,

Simple in construction, economical, close regulation, smooth running.

Adapted for ELECTRIC LIGHTING.

NEWELL BROTHERS, Cleveland, O.

Forster, Hawes & Co.,

PIG IRON AND COKE,

636-638 The Rookery, Chicago.

AGENTS FOR

IROQUOIS, STERLING SCOTCH, PEERLESS, MALLEABLE BESSEMER.

SLOSS, NORTHERN and SOUTHERN CHARCOAL IRON

Rainey's Coke.

GREY IRON CASTINGS,

Light and Medium weight,

FINE QUALITY.

The Taylor & Boggis Foundry Co.,

CLEVELAND O.

Rainey - -

Connellsville

Furnace and Foundry

- - **Coke.**

The only Coke you can buy and know you are getting the best that can be manufactured. All our works in the heart of the Region, within four miles of Connellsville, Pa.

CAPACITY, 4,000 TONS DAILY.

W. J. Rainey, Cleveland, Ohio

MAIN OFFICE:

MERCANTILE BANK BUILDING.

BUFFALO VENTILATING FANS

ELECTRIC, STEAM AND PULLEY TYPES. GREATEST AIR VOLUME, LEAST POWER

BUFFALO FORGE CO. BUFFALO, N.Y. U.S.A.

TURNBUCKLES.

Cleveland City Forge & Iron Co.,

CLEVELAND, O.

ILLINOIS SCREW CO.,

50-52 S. Canal st., Chicago.

Geo. H. Anderson & Co.,

524 Standard Bldg., Wood St.

PITTSBURG, PA.

High Grade Fire Brick

GRATE SETTINGS, ETC.

BRANDS:

"Anchor," Extra. "Garfield," No. 1. "I X L" Sand.

Locomotive Tile a Specialty.

Works and Mines at Bolivar, Pa.

Subscribe for The Iron Trade Review, $3 a year.

WILLIAM B. POLLOCK & CO., YOUNGSTOWN, OHIO.

MANUFACTURERS OF

STEAM BOILERS--EVERY TYPE--SHEET AND PLATE WORK,

Penstocks, Ladles, Oil and Water Tanks, Buildings, Cupolas, Blast Furnaces, Tanks, Smelters, Gas Producers, Converters, Receivers, Large Draught Stacks.

Riveted Pipe for Water, Gas, Air or Steam. Plate Construction--All Kinds.

STILWELL'S

PATENT LIME-EXTRACTING

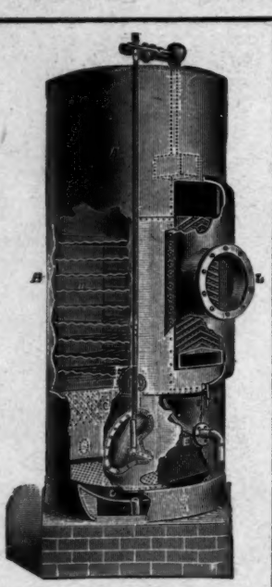
HEATER AND FILTER

COMBINED.

Is the only lime-extracting Heater that will prevent Scale in Steam Boilers, removing all impurities from the water before it enters the boiler.

. Thoroughly Tested. .

OVER 8,000 OF THEM IN DAILY USE.



ILLUSTRATED CATALOGUES.

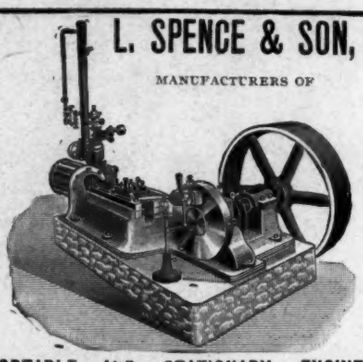
Stilwell-Bierce & Smith-Vaile Company,

DAYTON, OHIO.

CHICAGO OFFICE, 63 S. Canal St.

L. SPENCE & SON,

MANUFACTURERS OF



PORTABLE AND STATIONARY ENGINES,

From 6 to 400 H. P.

Large Engines for Rolling Mills and Blast Furnaces

Send for illustrated catalogue.

Martin's Ferry, Ohio.

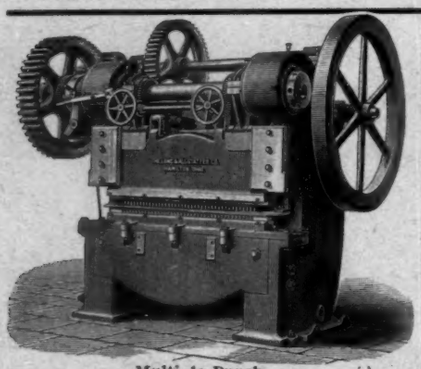
NOW is the time to INVEST in

SOUTHERN TIMBER-MINERAL LANDS,

Before prices advance. All kinds of mines for sale.

E. C. ROBERTSON,

Terms Easy. CINCINNATI, O. Titles Perfect



Multiple Punch. (2)

—THE—

Long & Allstatter Co.

HAMILTON, O., U. S. A.

Manufacturers of Belt, Steam and Electrically driven

Power Punches and Shears,

for all kinds of Boiler, Tank and Structural Iron Work, Rolling Mills, Locomotive Shops, Car and Wagon Shops, Plow Shops, etc. Send for catalogue.

GASOLINE ENGINES

Stationary & Portable

ALL SIZES.

Dwarfs in size and Giants in Strength.

Costs only 10 cents a Day per H. P. to run them, & scarcely any attention.

EVERY ENGINE GUARANTEED

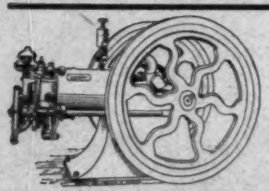
Write for particulars and testimonials.

THE VANDUZEN GAS & GASOLINE ENGINE CO.

CINCINNATI, O.

Mention this paper when you write.

Subscribe for the Iron Trade Review, $3 per year.



THE "LAMBERT"

GAS AND GASOLINE ENGINE.

Use gasoline direct from the tank. No boiler, no fire, no engineer. Cheapest power on earth. Made in all sizes from one to 50 horse power. Write for description and prices.

THE BUCKEYE MFG. CO.,

P. O. box A. Union City, Ind.

C. K. PITTMAN,

SHIPPER OF

Coal & Coke

Best Grades of Coke a Specialty.

975 Old Colony Building, Chicago.

CARY & MOORE

CHEMISTS,

1760 Monadnock Building, CHICAGO.

ANALYSES OF ORES, MINERALS, IRON, STEEL AND OTHER METALS,

ALSO OF

WATERS, OILS, COAL, AND FOUNDRY SUPPLIES.

GOLD AND SILVER ASSAYING.

Any time you are in the market to buy

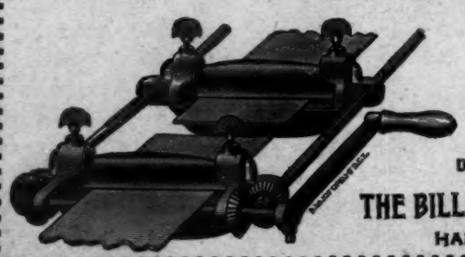
STEEL RAILS,

write to us. We can furnish any weight of New Rails; we have for immediate delivery 400 tons of second-hand 60 lb. Steel T Rails, 100 tons of 35-lb. girder and 300 tons of 45-lb. flat steel, all fit to relay.

ROBINSON & ORR,

419 Wood St., PITTSBURG, PA.

Patent Belt Clamps



EIGHT SIZES

. . FROM . .

8 to 36 Inches.

Drop Forgings of Every Description

THE BILLINGS & SPENCER CO.

HARTFORD, CONN.

H. L. HOLLIS. F. A. EMMERTON.

HOLLIS & EMMERTON

ANALYTICAL CHEMISTS.

Mining and Metallurgical Engineers.

ADVICE GIVEN ON FOUNDRY MIXTURES.

Analyses of Ores, Slags, Metals, Fuels, FOUNDRY SUPPLIES, ETC.

1232 The Rookery, CHICAGO. 804 Perry-Payne Bldg. CLEVELAND.

DICKMAN & MACKENZIE,

CLEVELAND, 71 Atwater Bldg. CHICAGO, 1224 Rookery Bldg.

Mining properties examined. Ores sampled at mines, furnaces and all lake ports.

General analyses of Ores, Slags, Metals, Fuel, Foundry Materials and Products, etc.

CHEMISTS AND ENGINEERS.

THE IRON TRADE REVIEW

VOLUME XXVII. CLEVELAND, O. JUNE 7, 1894. CHICAGO, ILL. NUMBER 23.

THE WEEK IN IRON CIRCLES.

GENERAL FEATURES.

The beginning of the end of the coal strike is foreshadowed in the action of the United Mine Workers at Columbus, O., Tuesday, in agreeing to a settlement of the trouble in district conferences. These are to be held Saturday and the resumption of work by the strikers may be looked for in some of the districts in the following week. The effect of this action will be to further weaken the strikers in the Connellsville region. As it is, the operators are steadily increasing their output and one blast furnace in Pittsburg has seen its way clear to resume. The week has brought few developments in the iron trade. Reports of further transactions in Lake Superior ores call attention to the fact that the amount sold is considerably in excess of sales at this time last year, conservative estimates putting the total well beyond 5,000,000 tons. The pig iron market has shown somewhat increased buying and inquiry, in foundry and forge, with continued firmness in grades which are in short supply, but generally speaking prices are unchanged. Chicago reports several transactions in local coke, while Southern iron has done better than for several weeks. Pipe foundries have been buying from Cincinnati and Louisville houses, and in all quarters a better movement of iron is noted, owing, doubtless, to the freight advances on the 15th. Little is to be said of Bessemer. A few spot lots have changed hands at $13.75, Pittsburg, and off-grade iron has brought but little less. Valley furnaces have done very little selling for future delivery in the past week. At Pittsburg a 5,000-ton sale for delivery in 30 days after resumption was made at $12.60. In the billet market there is very little disposition to make engagements for the future, but it is agreed that there will be no approach to the low prices that prevailed before the strike. Small spot transactions are noted at $19.50, Pittsburg and Wheeling. More rolling mills have had to stop the past week because coal could not be had. Foundries have been better able to get coke where they were willing to pay the price, but many find operation on this basis unprofitable. Finished material is bringing better prices. Where orders are urgent, buyers of bars and of structural material are content to accommodate themselves to sizes that are in stock at mill, where there is not too great a departure from their requirements. It is believed that the accumulation of suppressed business during the coal strike will keep the mills busy for weeks after the start-up.

THE CLEVELAND OUTLOOK.

More iron ore has been sold in the past week, and the scarcity of standard old range Bessemers has been impressed afresh upon buyers, who have found it impossible to get ores which figured largely in the early sales. Estimates by good authorities put the sales of Bessemer already made in the neighborhood of 5,000,000 tons—1,100,000 of Mesabi, 1,400,000 Gogebic, 1,100,000 Vermilion and 1,400,000 divided between Marquette and Menominee. It is probable that non Bessemer transactions will total a half million. Later buyers, it would seem, must look to the Mesabi if any considerable tonnage is desired, and even there, limitations exist, due to inadequate dock facilities and to the fact that in open-pit mining stockpiles cannot be made, and cars must be available to take out the ore as the steam shovel wins it, or mining operations must suspend. It is reported that a deal has been made by which the Carnegie Steel Co. acquires an interest in the Oliver property. This fixes the destination of half the product of the Mesabi Mountain, at least.

Pig Iron. There is an abundance of speculation as to the future of Bessemer pig iron, contingent on the settlement of the strike, but a corresponding absence of actual contracting. Before the strike, Eastern furnaces had largely ceased making Bessemer and the steel works dependent upon them were buyers from the valleys and Pittsburg, so that all the furnaces in those districts accustomed to making Bessemer were burdened for that product. Eastern buyers were in the market for 50,000 tons of Bessemer when the strike stopped Ohio and Pittsburg furnaces. Every steel plant in Pittsburg will be in the market for Bessemer after the resumption, just as every converting concern, before the strike, was a buyer of Bessemer iron beyond its own furnace production. For several weeks after coke becomes available most Valley and Pittsburg furnaces, it is said, will be kept busy on unfulfilled contracts. Few of them are in position to take contracts for delivery within 30 days after starting up. According to the views of some furnacemen, the demand for Bessemer will be quite as urgent immediately after the strike as it has been in the past three weeks, and those thus thinking are unwilling to sell on the basis of $11.15 at furnace, named in a few light transactions. Reports from Pittsburg are that one Carrie furnace has resumed, that one Lucy is in blast and two furnaces at Bessemer. Foundry iron is in statu quo. Demand does not grow, and the advance referred to two weeks ago is only nominal.

Finished Material. Western rolling mills have made a smaller output the past week than in the one preceding and those able to fill orders because of gas or oil fuel, find customers extremely urgent about shipments. Bar iron is about $1 a ton above prices ruling before the strike. A greater advance was asked for a time, but the market would not support it. In steel sheets, the slight advance made has been maintained. Structural material is much more firmly held. Sales from stock have been made at 1.50c, Cleveland. Tank steel has sold at 1.25c, Pittsburg. New inquiry in finished material is of only fair proportions.

THE CHICAGO OUTLOOK.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

By far the strongest branch of the metal market is pig iron. Other branches have done fairly well in the past week in the way of sales and prices are firm, but there have been no advances. In pig iron, however, prices are advanced and sales have been considerably larger than they were in the previous week. The coal strike has had no further effect upon the market beyond what was noted last week, and while some concerns have been compelled to shut down, the trouble has mostly been in the high price of fuel and in the scare.

PIG IRON.—Sales of local coke iron in the past week have been larger than they have been in any one week for some time and several single sales of good size have been closed. One order of 2,000 tons was received, and several ranging from 500 tons up. Southern iron has done rather better too, although no large single orders have been received. Lake Superior charcoal has been quiet, with sales limited to car load lots, with the exception of one large sale of off-grade iron. Quotations on Northern iron are even firmer than they were a week ago, and some of the dealers have advanced their prices 25 cents a ton, but others have not, and our quotations are unchanged. Southern iron is considerably higher than at the time of our last report, and our quotations are advanced accordingly. Some of the Southern grades of iron, notably silvery and No. 2 soft, are almost entirely out of the market; and in fact the only grades of which there is plenty are foundry irons and No. 1 soft. Northern furnaces are also short of several grades, and this fact taken in connection with the fact that consumers have almost no stocks in their yards, would lead one to believe that prices must go still higher. Freight rates will be advanced on the 15th, and this also will induce higher values. In fact everything seems to point to a bull condition of the market.

BARS.—Quite a few sales of moderate amounts of bar iron have been made in the past week at 1.10c to 1.15c. Steel bars are in good demand, but the mills are not particularly anxious to sell, owing to the uncertain market on billets. Quotations range from 1.25c to 1.35c.

STRUCTURAL MATERIAL.—Quite a good business has been done in the past week in small orders, but no large sales have been. Quotations are as follows: Beams and channels, 1.45c; angles, 1.40c to 1.45c; plates, 1.45c and 1.50c; tees, 1.65c to 1.70c. Small lots from stock are .10c to .15c higher.

RAILS AND TRACK SUPPLIES.—The demand for rails is still quite large and several orders of good size have been placed in the past week. Quotations are unchanged. Rails, $25 to $27; splice bars, 1.40c; track bolts, 2.20c to 2.30c; spikes, 1.55c to 1.70c.

BILLETS AND RODS.—There is no change in the situation, and no sales have been made in the past week Quotations are $19.50 for billets, and $25.50 to $26 for rods.

PLATES.—Business has been rather light except in small orders from stock. Prices are as last reported. Tank steel, 1.45c to 1.50c; flange steel, 1.65c to 1.75c; fire box steel, 3.75c to 4c; boiler tubes, 75 per cent. discount.

MERCHANT STEEL.—Prices continue to be very firm, but sales are limited to small orders from stock. Open hearth spring, machinery and tire, 1.85c to 1.90c; crucible spring, 3.50c; machinery, 4.50c to 4.75c; tool steel, 6½c and upwards.

SHEETS.—Black sheets continue to be in good demand and several good sized sales were made in the past week. Quotations are 2.40c to 2.50c for No. 27 common. Galvanized iron is in good demand, and some fair sized sales were made. Quotations are still made at 75 and 10 per cent. discount on mill shipments.

OLD RAILS AND WHEELS.—The market is quiet, and no sales are reported. Prices are nominal at $7 to $10, according to length for old steel rails, $10 for old iron rails, and $10 to $10.75 for old car wheels.

SCRAP.—A sale of 1,000 tons of steel scrap is reported to go East. The price is not obtainable. Aside from this, business has been small, and prices are unchanged. No. 1 forge, $9; No. 1 mill, $6 to $6.50; No. 1 machinery, $7; axles, $13; cast borings, $3 50; wrought turnings, $4; axle turnings, $5.50; mixed steel, $5; coil steel, $7; leaf steel, $8; heavy cast, $7; stove plate, $5.

GENERAL MARKET RESUME.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Pittsburg. The scarcity of material makes quotations on certain departments of the market merely nominal. A few sales of Bessemer were made within the week for delivery in July and August, prices ranging from $12.25 to $12.50, Two transactions are reported in which shipments are to be made in the first 30 days after the settlement of the strike. These were at $12.60 and $12.75 respectively for 5,000 and 2,500 tons. Furnaces are well filled up with contracis on which they must make shipments as soon as fuel can be obtained, some of them having been sold ahead for four months when fuel failed them. Much of this iron is for shipment to the East. Billets are practically beyond reach in this market. Spot lots of a few hundred tons changed hands the past week at $19.50. At Wheeling, where the fuel supply is better, transactions are still made, the basis being $19.50@$20. Mill iron is a trifle firmer; foundry grades are unchanged. No. 1 Carrie furnace has resumed on Bessemer, having received an initial supply of coke; otherwise the furnace situation is unchanged. The coke operators are bringing more new men into the region, and it is claimed nearly 4,000 ovens are now in blast, the expectation being to send out about 1,500 cars this week. In finished material mills are securing better prices, but prompt shipment is practically out of the question, except from stock. Tank plates are quoted 1.25c. to 1.30c.; beams and channels, 1.35c. to 1.45c.; tees, 1.45c. to 1.55c.; sheared bridge plates, 1.25. The demand for wrought pipe is increasing and an advance has been made.

Cincinnati. A somewhat better demand is noticed for various foundry grades of iron, but it is mainly for small lots, early delivery. One or two sizeable contracts with pipe companies have been closed. No other important buying for forward deliveries is reported. There is some increase in puddling among Western rolling mills, but most of them are working up old stocks of pig iron on hand, and little buying has developed as yet from that source. A few very small car orders have been taken by Western car works, but hardly enough in the aggregate to make any appreciable increase in the demand for wheel irons. Railroads, as a whole, are restricting their purchases as closely as ever.

Buffalo. Locally, the past week has been one of the heaviest in shipments of pig iron which has been experienced in months. Whether this is entirely due to a policy on the part of buyers to take in supplies before the general freight advance lately announced, or whether it indicates a genuine improvement in demand has not yet transpired. We note an absence of cutting in prices and a tendency to decline business offered below asking rates. Lake Superior charcoal iron is more active.

THE IRON TRADE REVIEW

DEVOTED TO

IRON AND STEEL MANUFACTURE, FOUNDRY AND MACHINERY TRADES, IRON ORE PRODUCTION, TRANSPORTATION, AND GENERAL INDUSTRIAL PROGRESS.

PUBLISHED EVERY THURSDAY BY

THE IRON TRADE REVIEW CO.,

CLEVELAND, OHIO.

CLEVELAND:
27 VINCENT STREET.
A. I. FINDLEY, Editor.

CHICAGO:
1141 MONADNOCK BLOCK.
B. M. GARDNER, Associate Editor and Western Manager.

TERMS OF SUBSCRIPTION, (strictly in advance):

One year.....$3 00
Six months.....1 50
Three months.....75

Advertising Rates Furnished on Application.

The Cleveland News Co. will supply the trade with THE IRON TRADE REVIEW, through the regular channels of the American News Co.

ENTERED AT THE POST OFFICE IN CLEVELAND, O., AS SECOND CLASS MATTER.

JUNE 7, 1894.

IT would seem that Secretary Herbert, Capt. Sampson, Prof. Alger and others of the Navy Department have overdone the business of making Superintendent Schwab the scapegoat of the alleged armor plate irregularities at Homestead.

IT is said on behalf of the railroads that the reductions in iron and steel freights made several weeks ago did not stimulate business, and therefore the restoration was ordered for June 15. Doubtless the statement is correct; but neither have the lower and lower prices which the iron and steel trade has been making in the past year helped sellers. And if the railroad companies recognize at all that freights should be measurably adjusted to market conditions, there is a very good reason, from the standpoint of iron shippers, why the low rates should continue. In foundry pig iron, at least, there is no improvement to warrant a return to the higher freights.

THE Tin-Plate Consumers' Association—which might better be called the "Tin Plate Importers' Association"—send a remonstrance to the Senate Finance Committee in which they say they are "confronted by a Democratic measure which proposes a duty upon tin plates of 1 1-5 cents per pound, to take effect Oct. 1, 1894, as against the promise in the Democratic bill passed in the last House of Representatives to make tin plate free Oct. 1, 1894." All they ask, they say farther on, "is bare justice from those elected as friends of tariff reform to legislate for the people as a whole, and not for the benefit of a few manufacturers." If for "people as a whole," there had been substituted "Welsh tin plate manufacturers and the importers of tin plate," this protest would have been more truthful. The past year has demonstrated that the few cents that a tariff may add to the cost of a workingman's dinner pail is not quite so important a matter as whether the said workingman shall have an opportunity to carry a dinner pail. The "few manufacturers" referred to in the tinplate importers' protest are in reality an army of tin-plate factory, black plate mill, billet mill, blast furnace, iron mining, railroad and vessel employes—tens of thousands of them—who will buy, not only dinner pails, but bread, meat, shoes, clothing. But here we fall into a line of thinking that is not new and that, at any rate, need not be gone over before readers of this paper. But if the Tin Plate Consumers' Association insist that a protective duty of 1.2c. on tin plate doesn't benefit the whole people, let them simply think of it as a revenue duty that goes to meet the necessary expenses of a great government whose "benefits to the whole people" cannot be measured in terms of dollars and cents.

OF the minor questions which arise to perplex the editorial mind, one of the most puzzling is the proper spelling of the name of the last developed iron range in the Lake Superior region. So far the weight of general custom seems to be in favor of "Mesaba," but there is almost equally good authority for "Mesabi." We have seen "Missaba" used also, and the prominent elevation which gave the range its name is frequently called "Missabe" Mountain. While the question is not of great importance, it seems as if it ought to be settled, and perhaps some of our correspondents may be able to help to a decision.—[Engineering and Mining Journal.

The Geological Survey of Minnesota and the U. S. Geological Survey spell it "Mesabi," and that form was adopted by this paper last year. The earlier form, shown in Nicolette's map more than 30 years ago, was "Missabay." Whittlesey, reproducing a part of the map in 1866, spelled it "Mesabi," and this has been used in the reports of the State Geological Survey for 15 years. It was thought to represent more correctly the Chippewa word, the accent of which is on the second syllable, while the final vowel is slighted, being closely represented by short *i*. *Mesabi* has priority over all other current forms, including *Mesaba*, *Missabe*, *Missaba*, *Mesabe* and *Missabi*.

IT is certain that when the much and long-wished-for-revival at last comes, no industry will feel its beneficial results more quickly or more deeply than will that of the manufacture of all kinds of electrical machinery and appliances. The great activity in this industry, that had only gotten fairly under way when the reaction set in a year ago, was a very genuine one, and when the times are again better it is morally certain that the business in this line will be greater than ever before. The demand for the projected electric roads, for the new lighting plants, for the new motors and dynamos, is a growing one, and if for a time suppressed, is sure to arise again like a hidden stream, with greater force than before.—[Boston Manufacturers' Gazette.

And when the increased demand for electric appliances comes—particularly for electric railroad building in streets and between towns—there will be so much added to the call for iron and steel. With the passing of steam railroad demand, as an influential factor in the market, electric roads and electric power appliances of all descriptions are becoming more and more an index of the iron trade. The iron ore interest had begun to look to the expansion of electrical industries that has gone on so rapidly in the past few years, to absorb the increasing output of ores. That was before the depression had confounded all calculations. But whenever the reaction comes, it is plain that electrical equipment manufacturers will be among the leaders on the up-grade.

ON another page we give the provisions of the new Amalgamated Association scale made at the May convention in Cleveland. It has been sent to the manufacturers and there will be conferences before July 1, with a view to avoiding a long shut down. It will be noticed that the wages prevailing for the past few months are asked for by the Association, in most departments, and that the inroad of non-unionism, with consequent decline in wages, is recognized. Puddling is kept at $4 and three turns in puddle mills are permitted. A separate skelp

mill scale, with 10 per cent. off the pay of roller and heater, is the response to the claims of pipe iron manufacturers. In the structural mill scale a change is introduced, in the taking in of 22 inch mills. In the sheet mill scale the present rates are substantially retained, and manufacturers have intimated already that such a basis is too high, with the proposed tariff reductions in effect. It is not unlikely, therefore, that some provision will be sought in conference for a termination of the new scale on the taking effect of the new tariff bill. The scale, it will be noted, is drawn for the year. It was not to be expected that the Association would voluntarily offer a perpetual scale with a 60-day notice clause attached. The intimation is made that in valley mills, which secured that proviso in their last conference, the 60-day arrangement will be recognized, but that at all other Western mills, including those in the Pittsburg district, signatures for a year will be required. There is a chance for trouble here, and the intimation is already given from Pittsburg that manufacturers in that district will insist on any concessions that are going.

THE decline in pig iron stocks that will be shown by the June statement will be interesting as a matter of comparison, and particularly because of the general knowledge that it is large. But the market long ago cut loose from stock statistics, the question of visible supply being practically no element in the case with the immense producing capacity that can be quickly brought into requisition. In the United Kingdom, also, prices are dragging persistently, in spite of the notable reductions in stock shown in the following from Rogers, Brown & Co.'s latest bulletin:

Attention is called to the heavy reduction of stocks that has been going on in Great Britain, as having an indirect bearing upon the situation here. Scotch warrants have declined, in a little over a year, from about 1,000,000 to 314,000 tons. Middlesbrough stocks have declined from 500,000 tons to about 100,000 tons, while hematite or Bessemer has gone down from 500,000 tons to 136,000 tons. The world's supply of iron is probably at a lower point to-day than it has been for many years.

THE next important industrial combination will be among the manufacturers of vapor stoves. Arrangements are practically consummated that will amalgamate all the companies in the country, except one or two of the smaller concerns. The object is the familiar one of reducing the expenses of marketing the product, which, in all closely competitive and over-done industries, considerably exceeds manufacturing cost. Dividends may thus be increased without adding to the selling price. The immediate sufferers will be the salesmen whose services will be dispensed with. They will have the usual recourse—liberty to attach themselves to some other overdone industry and help to hasten the day of amalgamation there.

THE value of all iron and steel imports to the United States in April, 1894, was $1,539,003 as against $3,179,833 in April of last year—a falling off of over 50 per cent. Iron ore imports in the month were 14,137 tons; in April last year, 60,368 tons. Tin plate imports were 17,105 gross tons, against 29,687 tons in April, 1893. Pig iron imports were 1,669 tons; in April last year, 6,711 tons. For the 10 months ending April 30, 1894, pig iron imports were 22,684 tons; for the like period ending April 30, 1893, 49,106 tons. Iron ore imports in the two 10-month periods were 196,726 tons and 575,768 tons respectively, a falling off of nearly 66 per cent.

THE RESPONSIBILITY FOR THE COAL RIOTS.

The press dispatches are full of news of riot and bloodshed, of moving military, of train capture and bridge burning and threatened dynamiting—all the outcome of the desperate spirit that pervades the ranks of starving mine strikers. In the public prints President McBride counsels abstinence from violence, and apparently recognizes that rioting will lose the strikers all the sympathy that the public had been so free to express. But Mr. McBride cannot escape the responsibility for the incendiary disposition that is now rampant.

The man who sets forces in motion, and for a time controls them, cannot say, when his control is gone, by reason of the terrific momentum attained, that he is no longer responsible. The leader of 200,000 strikers, desperate through destitution, cannot be ignorant, with all the history of such struggles before him, of what will inevitably come. President McBride has prolonged this struggle, obstinately and unreasonably, after he knew that a settlement could be had in more than half the districts involved. At the conference of miners in Columbus last Tuesday, both himself and Secretary McBryde, if the dispatches are correct, stoutly opposed to the last the proposition, finally adopted, permitting of district settlements.

There never was any warrant for the position taken by the leaders of the strike, that no settlement must be had unless the operators, willing to pay the price, brought to terms other operators, who not only would not pay the advance but would not treat with the miners' organization under any consideration. The whole country has been made to suffer and tens of thousands of men, in no way connected with the strike, have been deprived of wages because of this inexcusable and outrageously wrong position.

As it looks to-day, with public sentiment alienated, by their campaign of violence and destruction, and with a concession reluctantly forced from their officers, that should have been made willingly a month ago, the miners stand to get less out of the district settlements than would have been possible at any time since the strike began. And whatever may be gained is far more than offset by loss of life and property, and by hundreds of thousands in wages, which now, of all times in their lives, the strikers and the thousands they have thrown out of work can least afford to lose.

British Iron Trade Disappointing.

S. W. Royce & Co., of Manchester, Eng., under date of May 28, make the following comment on the pig iron and finished iron markets: "The course of affairs in the pig iron brach is disappointing. Prices of both Scotch and Middlesbrough iron have fallen steadily during the month, having lost altogether some 1s. to 1s. 3d. per ton, and are tending further downwards. The present position and prospects are unsatisfactory; shipments from Middlesbrough are disappointing, and little fresh business is being done and that only to cover immediate requirements, as is natural when prices are steadily falling. Makers are wanting fresh business, but there is no buying forward. In the manufactured iron trade in the Midlands, there is also only small business doing, and prices are on the easy side."

IN the week ending May 26, according to the *Courier*, the output of the Connellsville region was 30,393 tons, as against 16,450 tons the week previous. The shipments totaled 930 cars, as compared with 570 cars in the preceding week. The *Courier* sums up the active ovens as follows: H. C. Frick Coke Co., 1369; McClure Coke Co., 274; W. J. Rainey, 742; Cochran and others, 222; small operators, 110; furnace companies, 220—a total of 2,937. Total ovens out of blast, 14,576. There are nearly 4,000 ovens active this week, and shipments of 1,500 cars are promised.

AMONG THE IRON MINES.

The record of Lake Superior ore shipments in May is the largest ever made in that month. A total of 793,256 gross tons is reported through the Sault Canal in May, as against 256,821 tons the same month last year, a most surprising increase. In April there were carried through the Sault 50,447 gross tons, making the total out of Lake Superior to June 1, 843,703 tons. The shipments from Escanaba are not officially given, but estimating them at 200,000 tons to June 1, would give a total from upper lake ports to that date, of 1,043,703 tons. This is a surprising record, in view of the dock troubles, the number of boats out of commission and the difficulty of getting fuel throughout the month of May. It need hardly be expected that such a rate of shipments will be kept up to the end of the season. The total shipments of ore from Ashland in May were 321,021 gross tons; from Two Harbors, 239,106. This leaves about 233,000 tons to be divided between Marquette and Duluth. The Two Harbors shipments are with one exception—July, 1892—the greatest month's record in the history of that port. The total of clearances was 112, and the average cargo 2,134 tons. The season's shipments from Two Harbors show a total of 281,365 tons to June 1—177,901 tons of Vermilion ores and 103,464 tons of Mesabi (Canton, 68,665; Franklin, 34,799). Last year's Escanaba shipments were over 700,000 tons to June 1.

The mines at Iron Mountain, Mich., have been assessed as follows: Chapin, $165,000; Pewabic, $75,000; Millie, $15,000; Hamilton, $10,000; Ludington, $17,500. This is just one-fourth of what they were assessed at last year. At Norway, the Aragon mine has been assessed at $125,000, and the Penn company's mines at $140,000.

Operations have been resumed at the Dunn mine, at Crystal Falls, Mich., after eight months in which not a single mine in that district has been worked. The members of the firm of Corrigan, McKinney & Co. and others have incorporated the Dunn Mining Co., under the laws of Ohio, and that company will operate the mine, a sufficiently low royalty having been secured from the fee-owners. It is understood that a 50,000-ton sale of the ore has been made. Miners are to receive $1.25 a day and surfacemen $1. A force of 75 men is to be given employment.

Leonidas Merritt, has brought suit against the Duluth, Mesabi & Northern road to recover $45,992.50. He alleges that from Oct. 27, 1891, to Oct. 13, 1893, he was vice-president of the road and outside of the duties of such office and at the request of the defendant company performed services as managing agent at the office in New York. He also at the defendant's request acted as financial agent in the negotiation of loans and the procurement of money which was used in building the railway and docks. The company promised to pay as much money as the services were reasonably worth. He puts the value at $40,000, and not a cent of which he has yet received.

It is reported that an order has been issued, that no Sunday work shall be done at the Consolidated Mines, on the Mesabi range.

A new basis of work and wages is talked of in connection with the Rockefeller properties on the Mesabi. A fair day's work is to be the basis of the regular day's wages, while any increase in the amount of ore turned out will be paid for at a proportionate rate. Contracts for this change are now being made out.

The Duluth, Mesabi & Northern has completed tracks to the Franklin mine and for the balance of the season shipments will be made via Duluth.

The first two days of last week 4,000 tons of ore per day were loaded with one shovel at the Oliver mine. Shipments are averaging 2,500 tons daily.

THE Falcon Iron & Nail Co. won its injunction suit against the city of Niles, O., to prevent the city from issuing $10,000 bonds to give a bonus to the new rolling mill which R. G. Sykes and others proposed to erect there.

N. & G. TAYLOR Co., of Philadelphia, say that their output of tinplate last week was the largest since they started their works about two years ago.

THE NEW AMALGAMATED SCALE.

The new rolling mill scale adopted at the recent convention of the Amalgamated Association, in Cleveland, has been printed and transmitted to the manufacturers. A copy of the document, which we have received through the courtesy of the Association's officers, shows that the unofficial statements made in these columns as to its contents were correct. In the main the wages now paid in union mills are asked for by the men, and concessions which have been made in the past year without formal alteration of the scale, are now given sanction in black and white.

The first important change from the draft of last year's scale is in the omission of the words "except boiling department" in the fifth paragraph of the "memorandum of agreement." This permits three puddling turns in 24 hours, a practice which the Amalgamated Association has always resisted heretofore.

Boiling is maintained at $4 a ton, based on a 1½ cent card rate. A 15th foot note is added to the boiling scale, as follows: "When mixed material is worked, which is not provided for by the scale, the mean price between the prices of the material used shall be made, the proportion not to go below one-third; this not to apply when worked with metal."

In the muck or puddle mill scale, the stipulation is retained that the roller shall receive ⅛ the base price paid for boiling. In one Cleveland mill a strike of rollers took place last year, when the company attempted to enforce this rule, the rollers, who had been receiving 59⅜c. a ton under $4.75 puddling, refusing to come down to 50c. when the price of puddling was reduced to $4. The Amalgamated officers decided against the men and the Association has now confirmed the reduction. A fifth paragraph is added under the heading "Muck or Puddle Mill." It provides that "on mills averaging less than 15 tons per turn in two weeks, the company shall pay the drag-outs."

For "scrapping and busheling," the scale provides $1.55 a ton, the same as now in force, and for knobbling the base price is $3.80. For heating slabs and shingling, current prices are retained, 60 7-10 being the price for shingling muck iron and re-hammered iron. In bar and nail plate mills, rolling and heating are to be paid at 56 7-10c. per ton, as at present.

A new heading that appears in this year's scale is "Prices for Mills Making a Specialty of Working Pipe or Skelp from Iron or Steel." The following is the scale, which, as will be noticed later on, is 10 per cent. below the base price in guide, 10-inch, hoop and cotton tie mills. The roller in the latter gets $1.17½, while for pipe or skelp iron the pay is $1.06:

"When working common sized skelp, or pipe, iron or steel, on small mills the prices at one and one-half cent card rate, shall be $1.06 and 53 cents for heating and 26½ cents for roughing and same for catching, and shall advance 2 per cent. additional for each 1-10 advance above one and one-half cent card to two and one-half cent card, and 2 per cent. decline for each reduction of 1-10 to one and one-half cent card.

"Rollers, heaters and roughers shall be paid by the company.

"Bar and twelve-inch mills, when working pipe or skelp iron or steel, at one and one-half cent card rate:

"Rolling..... 51c. per ton.
"Heating..... 51c. per ton.

"Catching shall be five-eighths of the price paid for rolling and shall be paid by the company.

"When working small sized skelp, the price shall be $2.12 for the mill.

"One man's help shall be furnished by the company on piles of 150 lbs., and an additional man on piles of 250 lbs. to shove under at the rolls on all passes.

"Prices to advance and decline in the same ratio as bar mill scales.

"Plate and tank mills, when working pipe iron or steel at one and one-half cent card rate, the price shall be as follows, and shall advance and decline in the same ratio as plate mill scale.

"Rolling.....46.6 per ton.
"Heating.....58.3 per ton.

"It is understood that none of the above prices will be used as a criterion to reduce the prices paid for working other material."

The skelp mill reduction meets the claim of valley mill owners that in mills in which there is very little changing of rolls, steady runs being possible without the interruptions that come on other work, there should be a special concession.

The "Guide, Ten-Inch, Hoop and Cotton Tie Mills" scales present the prevailing prices, the base being $1.17½ for rolling, 58¾c. for heating and 29⅜c. each for roughing and catching. In the scale as made in convention last year these were $1.45, 72½c. and 36¼c. respectively. In conference a 10 per cent. reduction was made and another 10 per cent. came off later.

In plate and tank mills the base is still 54c. per ton for rolling common iron and 64 8-10c. per ton for heating common iron. To foot note 8 this addition is made: "And it is understood that roll hands shall not be required to charge or anneal."

For rolling pipe iron on sheet and jobbing mills, $2.75 is the price, on a 1½ cent bar iron card.

The prices for rolling, as given in the sheet mill scale, are as follows: No. 8 and heavier, $3.24; Nos. 9 to 11, $3.60; Nos. 12 to 14, $4.32; Nos. 15 to 17, $5.00; Nos. 18 to 21, $6.08; Nos. 22 to 24, $7.20; Nos. 25 and 26, $8.28; No. 27, $9; No. 28, $9.59; No. 29, $10.03; No. 30, $10.80; No. 31, $14; No. 32, $17.

The sheet mill hands' scale is the same as the printed scale of one year ago: Single mill—pair heating per day, $2.25; matching, $2. Large double mill—pair heating, $2; doubling, $1.75; matching, $1.85. Small double mill—pair heating, $1.85; matching, $1.60; doubling, $1.50. The following paragraph (12) is added: "Twelve pairs of 144 inches long, and over, of sheet iron, to be the equivalent of 15 pairs of shorter lengths. Single iron and iron worked in pairs to be at the same ratio."

In tin and black plate mills the wages now prevailing are retained. For gauges 8 to 11 the price of rolling is $2.04; doubling, 93c.; heating, 85c.; shearing, on jaw or crocodile shears, 99c. For shearing on modern squaring shears, the price is $1.30 for 24 to 30; $1.50 for 31 and 32; $1.70 for 33 and 34; $1.90 for 35 and 36. All sheets rolled on tin mills over 14 square feet shall be paid for at sheet mill prices. Where improved squaring shears are used the company shall pay for grinding the knives. The limit of a turn's work of eight hours is fixed at 6,400 lbs. for No. 24, decreasing to 4,200 lbs. for No. 34.

The sheet and tin bar scale is based on 40½c. for rolling finished iron for sheet or tin bars, 1½c. bar iron card; 39c. for rolling muck iron, and 56 7-10c. for heating. Seven per cent. off for clippings.

The tin house scale is as follows: Tinning and washing—coke, terne and charcoal, 12c. per box; double rolling, 15c.; heavy coated terne, 16c.; old style, 18c. Assorting—coke, charcoal and terne, 4c.; double rolling, 5c. Catching—coke, charcoal and terne, 4c.; double rolling, 5c. Drawing, old style, 6c. Listing, old style, 4½c. Turning down—coke and terne, 4½c.; charcoal, 5c. The notes are: 1. Boys to turn down all plates worked endways. 2. No assorter shall assort for more than three stacks. 3. Standard to be 20x14 of 112 sheets to the box. 4. All boxes weighing over 136 pounds shall be counted as gains. 5. The output of each set shall not exceed 200 boxes per week.

The structural mill schedule shows an innovation. This year it includes 22-inch mills, for which the tonnage rates are as follows: Heater, output of one furnace, 46c.; heater's helpers, output of one furnace, 3 each, 21c.; piler and charger, output of mill, 8c.; second pilers and chargers, output of mill, 3 each, 6c.; buggyman, output of mill, 6c.; roller, 26c.; catcher, 13⅔c.; rougher-down, output of mill, 2 each, 11c.; rougher-up, output of mill, 2 each, 10⅔c.; hookers, front, output of mill, 2 each, 9c.; hooker, front, second, output of mill, 7c.; first straighteners, 2 each, 8c.; second straighteners, 2 each, 6c.; shearman, 9c. The foot notes are as follows: 1. On piles, 900 lbs. to 1,200 lbs., one extra man to be furnished by the company on each hook; piles from 1,200 lbs. to 2,000 lbs., two extra men on each extra hook shall be furnished. 2. Ten per cent. to be deducted from all unfinished iron for crops. 3. The above rates are predicated on 50 tons output on three furnaces or less and in order to be adopted by any mill the system in full must be followed.

The 18-inch mill scale is substantially that in force at the present time. As showing the reductions that have taken place in the year, we print side by side the scale prepared in last year's convention and the one now proposed by the Association:

Eighteen Inch Mill—1893.	Price Per Ton. 2,240 lbs
Heater	63c.
Roller	63c.
Catcher	39 3-8c.
Heater's Helper paid for output of 2 furnaces	12 3-20c.
Pilers and Chargers, each	10 4-5c.
Buggyman	11 1-4c.
Hookers, each—Front	11 1-4c.
Hookers, each—Back	10 4-5c.
First Straighteners, each	11 1-4c.
Second Straighteners, each	10 4-5c.
Shearman	19 4-5c.

Eighteen Inch Mill—1894.	Price Per Ton. 2,240 lbs.
Heater, output, one furnace	50c.
Heater's Helpers, output, one furnace each	20c.
Roller, output of mill	35c.
Catcher	22c.
Rough down	18c.
Rough up	16c.
Pilers and Chargers, each	8c.
Buggyman	9c.
Hookers, each—Front	9c.
Hookers, each—Back, 1 extra to spell front and b'k	8c.
First Straighteners, each	8c.
Shearman, each	9c.
Shearman's Helper	7c.

For wire rod mills the existing scale is proposed, with 27c. for rolling and 32 4-10c. for heating, which is 10 per cent. less than provided in the scale made in last year's convention.

"For the year ending June 30, 1895," is the title of the scale, and no provision is made anywhere for its termination on 60 days notice. That is a question which will be settled in conference. The valley manufacturers will undoubtedly ask to have the arrangement continued, under which they are now working, and it is a question whether the union mills in the Pittsburg district will sign for a year, as long as the 60 day clause is available to others.

On the Editorial Table.

We are in receipt of the new Directory to the Iron and Steel Works of the United States, of which we presented a statistical summary from advance information, in our last issue. There are several new features in this volume, including a list of works producing tinned or retinned stamped ware, a list of works making horse-shoe nails, a list of iron and steel bridge-building works and of iron and steel shipbuilding works. There are 300 pages, making a volume somewhat thicker than the last one. The price is $5 and orders should be addressed to James M. Swank, general manager, No. 261 South Fourth St., Philadelphia.

Part 10 of "The Book of the Fair" published by the Bancroft Co., the Auditorium, Chicago, is devoted chiefly to the Agricultural Building, though there are a number of full-page views of general features—all up to the high standard which the work has made for itself in its art reproductions. The volume contains the beginning of what promises to be one of its most interesting chapters, that devoted to the wonders of the Electricity Building.

The striking employes of the National Tube Works, at McKeesport, Pa., decided, 644 to 212, not to return to work unless their wages are increased. The company soon after announced its intention of resuming in a few days with new men, if their old employes do not care to work. At a conference with a board of trade committee, which was endeavoring to settle the strike, the company produced accounts and letters to show that an increase in wages was impossible. They cited the fact, as showing the condition of the market, that they had missed a $240,000 order for pipe from Canada after bidding on 1½ per cent. profit, so great had competition become. On Tuesday 240 of the old men went back to work. Strikers charged upon the mill, driving them out and severely injuring more than a dozen of them. Several thousand men were in the mob, which completely controlled the town

---

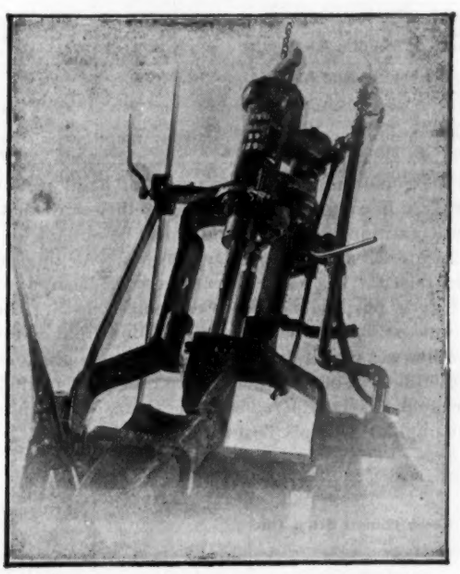
Reinhard Mannesmann, the well known German manufacturer of seamless tubing, whose exhibit at the World's Fair is well remembered, is now in the United States looking for a suitable locality in which to establish his industry. Among other places Youngstown, O., is being considered, and Mr. Mannesmann visited that place on Monday, being taken to the various iron works in the city and environs, by Messrs. Henry Wick and Myron C. Wick. The proposed plant would be a splendid addition to the Mahoning Valley's iron and steel industries. Youngstown's board of commerce is facilitating the project.

It is expected that the plant of the Britton Rolling Mill Co., of Cleveland, for rolling black plates for the manufacture of tin plate, will be in operation some time in June.

NEW PORTABLE STEAM HAMMER.

Theo. M. Shearer, of Butler, Pa., is the manufacturer of the patented portable rotary steam hammer shown in the accompanying illustration. Its principal use is in connection with the dressing of drilling tools for oil and gas wells. In the early history of the oil developments along Oil Creek, in Venango County, Pa., drilling tools were used that would nowadays be considered mere playthings. The average man could then take an auger stem and carry it on his shoulder, the bit or drill weighing, perhaps, 25 to 30 pounds. Very different are the auger stem and bits of the present day. At the Shearer shops at Mannington, W. Va., a set of 13-inch bits is being manufactured that will weigh 1,600 lbs., with 300 lbs. of steel in each.

As the drill passes through the different sands and rocks it wears away very fast and has to be spread and dressed frequently in order to maintain a uniform diameter of the well, to admit freely the casing used in shutting off the water from the lower sands. This spreading or dressing of the bits involves the most exhausting labor and is frequently accompanied by the overheating of the steel, thus rendering it practically unfit for use. The objects of Mr. Shearer's invention are to save this hard work, to save steel and to save time. The radical difference between this hammer and the ordinary one is that it can be made to quickly move all around the object desired to be operated upon. With ordinary hammers, the object to be operated upon is moved about, and the hammer remains stationary. It can be readily seen that the beveled edge of a bit could not be operated upon in the ordinary hammer, as the bit could not possibly be held in position to receive the stroke of the ram. This difficulty is overcome by this in-



NEW PORTABLE STEAM HAMMER.

vention. As soon as it becomes necessary to dress a bit, it is placed in the fire and when the proper heat is secured the pin end of the bit is placed against the stoving post so as not to injure the thread, and the hot end is laid upon the anvil of the hammer. The hammer frame resting or swinging upon two parallel pins, fitted into a stationary base, is then swung into position so as to operate upon the beveled edge of the bit. The latter is held in place firmly by two bars whose lower ends are fitted into projecting lugs on each side of the stationary base and held in place by a bolt passing through the bars and lugs. This permits them to swing from side to side. At their upper end they pass through a swivel yoke, which revolves in an arm bolted to the lower end of the cylinder. A set screw in the yoke forced upon the bars holds the hammer frame rigid at any desired point or angle. The ram is then put in motion and the hot end of the bit is moved forward and backward over the face of the anvil so as to receive the strokes of the ram over its whole width. The face of the ram is very narrow, so as to spread the bit and not upset it too much.

This process is accomplished by means of a lever having a loose collar attached to it, and fitting over the broad or concave sides of the bit and inserted at its lower extremity into a lug provided for the purpose in the stationary base. As soon as the beveled edges are hammered to a sharp point the set screw in the yoke is loosened and the hammer immediately swung into a vertical position, so as to operate upon the concave sides of the bit which have, by this time, become "upset" by the action of the ram upon the beveled edges. When this is done the hammer is swung on the other side of the vertical line, to an angle or point of the circle that will give the narrow side of the bit the proper clearance, and it is then hammered to the size required.

As the hammer is short in stroke, to make it as light as possible, a recess is made in the anvil into which the bit is dropped edgewise. By this means the full stroke of the hammer is obtained, and the bit completely dressed ready for use. The hammer, being top-heavy, is perfectly balanced by means of a weight attached to a rope, and this rope is run over two pulleys and fastened to the crossbar of the buffer at the top of the cylinder.

Personal.

Hon. M. A. Hanna, of M. A. Hanna & Co., Cleveland, was elected last week, vice president for Ohio, of the American Protective Tariff League, succeeding the late Hon. Geo. H. Ely, of Cleveland.

J. Parke Channing, of Calumet, Mich., has resigned his position as assistant general manager of the Calumet & Hecla Mining Co.

Walter Hinschman, of New York, Charles S. Hinschman, of Philadelphia, and L. Mendenhall, G. G. Hartley and Robert Mendenhall, of Duluth, made a tour of the Vermilion and Mesabi ranges last week. At Soudan they were joined by Pres. Bacon, of the Minnesota Iron Co. Mr. Chas. Hinchman is connected with the Pennsylvania Steel Co.

Capt. W. H. Jaques, who has been connected with the Bethlehem Iron Co. since 1886, as ordnance engineer, has successfully accomplished all the obligations involved in the enterprise inaugurated under his direction at that company's works, and under date of June 1 he announces his retirement from the company to become associated with Horace See, the well known engineer and naval architect. As a member of the firm of See & Jaques, Capt. Jaques will devote himself to general engineering work and consultation in connection with the manufacture and treatment of guns, armor, shafting and other war material, the machinery required for their production and especially with the fluid compression and hydraulic forging of steel, and the best types of armor. The engineering records of both gentlemen include some of the most advanced work of the time, in their special fields, and it need not be said that the combination carries the maximum of strength and influence.

Chas. H. Cramp, president; Benjamin Brewster, vice president; Henry W. Cramp, secretary and treasurer; Thomas Dolan, Clement A. Griscom, William M. Cramp, Samuel H. Cramp, Jacob C. Cramp and Henry Seligman are the directors elected by the Wm. Cramp & Sons' Ship & Engine Building Co., at Philadelphia, last week. The past year's business was the greatest in the company's history.

New Blast Furnace Leases.

Mr. W. C. Runyon, of Cleveland, well known in the iron ore trade, has leased the Sharon furnace, better known at the "Hall," at Sharon, Pa., and will start it on Bessemer iron as soon as coke is available. The furnace was last operated by P. L. Kimberly & Co., but was blown out in April. It is in good condition for successful operation. Mr. S. Allen Richards, a well known furnace manager, will be in charge. Mr. Richards operated the Joliet furnaces of the Illinois Steel Co., for some time, and later was in charge of the Minnesota Blast Furnace Co.'s West Duluth furnace. In the operation of the last-named furnace he used Mesabi ores entirely. The Hall furnace will use 25 per cent. Mesabi.

Corrigan, McKinney & Co., of Cleveland, have leased from the Cleveland Iron Co., the River Furnace, Cleveland, and the work of getting it in shape to blow in is now in progress. It is expected that the furnace will be making iron by Aug. 1. Pickands, Mather & Co. were the last lessees to operate the River furnace. It has been idle for upwards of 18 months. Last year Forsythe, Hyde & Co. leased it and had almost completed the installation of new equipment when they assigned.

MACHINE SHOP AND FOUNDRY.

FOUNDRY USE OF PHYSICAL AND CHEMICAL TESTS.*

BY W. J. KEEP, DETROIT.

I began this discussion by saying that the only way to arrive at correct conclusions regarding cast iron was by means of properly conducted physical tests explained by chemical analysis; also that the physical structure of cast iron is not wholly dependent on its chemical constitution; also that a determination of shrinkage and chill would indicate when the correct percentage of silicon was present, and that the strength and deflection would tell if the mixture had been arranged to the best advantage. Some have objected to my methods, rather than defend their own side of the case by facts and figures.

Opposition to New Methods.—There are those who always oppose a new manner of arriving at conclusions. Not one of those who have raised objections has ever used or seen my apparatus, or has seen one of my half-inch test bars. A letter lately received, speaks as follows: "The difficulty with the chemists, and with all who have not had practical experience with your admirable system, is that they are disqualified for an intelligent understanding of the question at all." It is easier to object and imagine difficulties, than it is to present results of original research. My effort has been to find reasons for the behavior of cast iron, and to present them in such a manner that the founder who has not had the advantage of a chemical education, can intelligently purchase and use iron.

The One-half Inch Square Test Bar.—The explanation of the influence of the five metaloids in cast iron, which has been made during the last six years, by a study of the half-inch bar, is all the defense that it needs. I gave a summary of these conclusions in my paper of April 4.

It has been stated that "test bars to be trustworthy must be of a size to give approximately constant results." The truth is, test bars to be trustworthy must be of a size to show correctly the quality of the iron; and cast iron always varies. I only recommend the half-inch test bar for iron that will run gray or nearly so in this size, and this covers nine-tenths of foundry practice. The large amount of surface exposed to the mold makes a uniform grain throughout, and causes it to indicate the slightest change in composition.

General Application of the Half-inch Test Bar.—The behavior of this bar is the measure of the effect of silicon in a casting whether large or small, just as a foot rule can measure a large or small object.

In the *Iron Age*, May 17, p. 946, Mr. E. H. Mumford (with Henry R. Worthington) says: "It may be taken for a fact that no one size of test bar is better adapted to a certain class of work than another. The great truth in this matter of test bars is, that whatever their shape, size or method of molding, they should always be made and tested in exactly the same way. Follow up Mr. Keep's system, and you will get results like what follows:

"If a water cylinder three inches thick and weighing eight tons, gives a bar in 'Keep's Test' that runs 450 in strength, .155 of an inch in shrinkage, and .08 of an inch chill, you may be sure that the casting is free from shrinkage strains, will cut easily and is strong. If the same casting gives you a Keep bar that runs 350 in strength, .170 of an inch shrinkage, and .25 of an inch chill, you may be sure that you have a casting that, while it looks close and strong, will take twice as long to machine, has put its thinner portions under immense initial stress, and is very likely, therefore, to show shrinkage cracks, as the iron has not the strength necessary to resist either these or its working bursting pressure in service afterward, certainly not both at once. All this the little half-inch bar tells you of the big casting, and it does it better than the larger bar would."

I am allowed to take the following from the books of one of our largest machine foundries: "By analysis, silicon 2.26, average chill of a Keep's bar .075, shrinkage .154, strength 436. Iron open and soft, perhaps our best iron for general work." 3.00 or 3.25 per cent. silicon, and shrinkage .125 will make stove plate, but a large machine casting must contain less silicon, which will be indicated by higher shrinkage.

Influence of Iron Standing in a Ladle.—I introduced in my last paper nine series of tests to indicate what could be shown by physical tests, and that chemical analysis could not do as much. I did not intend to turn the discussion in another direction. The 3.25 per cent. silicon iron, drawn from a cupola as fast as melted, produced stronger castings from the portion of iron which had been longest in the ladle. To get an explanation of the different experience of some who had observed an opposite effect, the experiment was tried at a prominent machine foundry in this city. The iron was for a 3-ton cylinder and was very dull. This is shown in Series X (continuing the numbers of my last paper).

SERIES X.

No. Test.	28 Lbs. Iron in One Ladle. (Rested.)	Dead Load.		Shrinkage.		Chill.
		Stren'th.	Deflec'n.	Square	Flat.	
806	Poured at once	.420	.21	.160	.166	.150
807	Poured ¾ minute later	.474	.24	.162	.....	.150
808	Poured ¾ minute later	.438	.22	.160	.....	.150

I also made a mixture of pig irons and scrap the same as in Series VII to IX, and melted it in a crucible. This is shown in numbers 803 to 805 of Series XI. I also melted one brand of pig iron in a crucible as shown in numbers 833 to 836.

SERIES XI.

No. Test.	28 Lbs. Iron in One Crucible. (Rested.)	Dead Load.		Shrinkage.		Chill.
		Stren'th.	Deflec'n.	Square	Flat.	
	Mixture like Series VII. to IX.					
803	Poured at once	.359	.21	.125	.143	.08
804	Poured 1¼ minutes later	.382	.21	.123	.145	.12
805	Poured 1¼ minutes later	.378	.21	.122	.....	.06
	One Brand Pig Iron Alone.					
833	Poured at once	.402	.26	.158	.159	.17
834	Poured 1¼ minutes later	.388	.23	.158	.159	.17
835	Poured 1¼ minutes later	.376	.20	.156	.159	.17
836	Poured 1¼ minutes later	.368	.17	.157	.158	.17

Both these and the tests in my paper of April 4 show how iron behaved in each case, and taken together show that under different conditions different results may be obtained.

The Influence of Wet and Dry Molds.—As this question has been raised, "Keep's Test" can give the desired information. I have purposely gone to extremes. In 814 the mold was so wet that one bar was perfectly hollow from a blow-hole. In the other wet molds the sand was as wet as possible to get sound castings. The dry molds were thoroughly dried. The regular mold was "tempered as for ordinary work, only rather dry" (Pamphlet "Keep's Test for Cast Iron," p. 7).

SERIES XII.

No. Test.	All Three Poured From One Ladle.	Dead Load.		Shrinkage.		Chill.
		Stren'th.	Deflec'n.	Square	Flat.	
814	Very wet mold	420	.22	.146	.149	.04
815	Regular mold	430	.23	.136	.142	.04
816	Dry mold	414	.23	.130	.142	.06
818	Wet mold	425	.22	.131	.145	.08
819	Regular	468	.25	.132	.143	.08
820	Dry mold	437	.23	.123	.138	.08
821	Wet mold	398	.22	.128	.145	.06
822	Regular mold	392	.22	.130	.146	.06
823	Dry mold	407	.23	.120	.140	.05
827	Wet mold	417	.23	.138	.147	.04
828	Regular mold	417	.24	.129	.144	.05
829	Dry mold	421	.24	.122	.140	.04
830	Wet mold	375	.21	.142	.150	.05
831	Regular mold	387	.22	.140	.148	.04
832	Dry mold	390	.22	.129	.141	.04

The Influence of Temperature of Cupola.—In the investigation of another subject the tests in series XIII were made. Tests 812, 813, 824 and 825 were from the first iron that came down, which boiled on the cupola bottom on account of the moisture which it contained. 812 and 824 were caught in a freshly dried ladle and then changed to another fresh ladle, the iron boiling in both. 813 was caught in a red hot ladle, next after 812, and shows only the influence of the boiling on the cupola bottom. 825 was caught in the hot ladle after pouring 824, but 300 pounds of iron had been taken out between

* Read before the Foundrymen's Association, at Philadelphia, June 6, 1894.

the catches, and the iron had improved. 815 and 826 were from the middle of the heat, and show average iron. All of the tests in this paper were on different days, and are each averages of from 3 to 5 test bars. (Series IV in my last paper is the test of the single bar of the set which was analyzed, while series VII to IX show the averages of the 3 test bars of each set. This explains the difference in the figures.)

SERIES XIII.

No. Test	Separate Ladle for Each Test.	Dead Load.		Shrinkage.		Chill.
		Stren'th.	Deflec'n.	Square	Flat.	
812	1st iron (after 200 lbs.)	.392	.21	.163	.187	.225
813	1st iron, next ladle	.350	.20	.164	.175	.150
815	Middle of heat	.430	.23	.136	.142	.040
817	Last of heat	.397	.21	.132	.148	.075
824	1st iron (after 300 lbs.)	.375	.19	.162	.186	.225
825	1st iron (after 600 lbs.)	.415	.21	.163	.167	.100
826	Middle of heat	.425	.23	.126	.141	.025

The Object in Producing these Examples is not to present new questions for discussion, but to show that the physical quality of cast iron is not wholly dependent upon its chemical composition, and that "Keep's Test" will not only always show the proper amount of silicon, but will show the influence of every condition met in foundry practice. Allow me in closing to again quote Mr. Mumford: "There has never been, and there hardly ever can be, a system of foundry testing so complete, and making it so certain that bars made now, or a year from now, in one shop or another, shall be so absolutely alike, as 'Keep's Mechanical Analysis'."

SHOP AND FOUNDRY NOTES.

U. S. Consul Monaghan writes from Chemnitz cautioning American manufacturers about selling their devices in Germany unless they take out patents in the empire. These patents, by the way, must be applied for simultaneously with the application for the United States patent. American machines are made from 20 to 30 per cent. cheaper in Germany than the price of the American make. He instances knitting machines invented in the United States of which formerly a few were sold at Chemnitz, enough at least to serve as models, that are now being made at or near Carmstadt, not far from Stuttgart, Wuertemberg, for 30 per cent. less than is asked for the same machine, *i. e.*, American made, in the United States. What is true of this knitting machine is true also of every machine not protected by patent rights taken out there. Sewing machines, agricultural machines, clipping machines, etc., are all copied, made, and sold there, and, as a rule, are 25 to 30 per cent. cheaper than with us. Consul Monagham also instances the case of an iron pump maker who found a pump at the World's Fair that suited his fancy, ordered several of them from the American manufacturer, and is now manufacturing them, and selling them much below the price quoted by the patentee.

Referring to the published threats of certain cast iron pipe manufacturers to charge higher prices in future to cities buying the World's Fair pipe, which Clow & Son have put on the market, the *Iron Age* says: "The quantity of second-hand pipe is not large, will probably soon be disposed of, and is not worth getting excited over. If threats are being made that the buyers of this pipe shall suffer in the future, such threats are in very bad taste and should be withdrawn with apologies."

American machinery manufacturers are still hearing from the Dutch swindlers, whose headquarters are chiefly in Amsterdam, Rotterdam and The Hague. These fellows have been preying on the English market for a long time, and are now operating with altogether too much success in the United States. It is surprising, after all that has been published on this subject, that American machinery makers would ship on account to unknown foreign buyers, particularly of Holland address. Reliable references should be insisted upon in every instance.

In an article in *The Foundry*, by S. Groves, the writer dwells upon the danger of the hammer test on cast-iron pipes when under pressure. He instances two pipes which were subjected to a pressure of 260 pounds, in which condition a ball weighing 1½ pounds was let fall upon them from varying heights. The pipes were then broken, and against wherever the ball had struck there were star-shaped fractures on the inside of the pipe, extending into the metal from 3-32-inch to 5-32-inch. From this he concludes that a hammer test of cast iron pipes instead of being a safeguard is a source of danger. The pipes tested were 4 inches diameter, 9 feet long, 3-8 inch metal. He infers that there is a like danger in the case of all castings that are to be used under high pressure, and from which the cores are loosened by hard hammer blows.

Gisholt Machine Co., Madison, Wis., have issued the first of a monthly series of pamphlets on turret-lathe practice, intended to illustrate the more common uses to which their class of turret machinery is adapted. The present number contains illustrations of turning plate couplings, making screws, turning Corliss engine bonnets and making shoulder studs.

U. S. Mineral Production in 1893.

Vol. 2 of "The Mineral Industry: Its Statistics, Technology and Trade," the statistical supplement of the *Engineering and Mining Journal*, has been published. A complete table of mineral production of the United States in 1893, with revised figures for 1892, has been included in the volume. It gives an idea of the immensity and variety of the mineral resources of the country that is obtainable from no other set of figures. The total value of the 53 non-metallic minerals produced in 1893 is put at $371,376,935; of the 13 metals, $267,707,795, as against $396,610,582, non-metallic, and $320.740,427, metallic, in 1892. The total for 1892, adding $7,500,000, estimated, for unspecified products is $724,821,009; for 1893, adding an estimate of $6,000,000 for unspecified products, $645,084,730. The *Engineering and Mining Journal* comments as follows:

"It will be seen that in the year 1893 the mineral and metal production of this country as compared with 1892 has not declined in quantity as much as might have been expected from the financial depression, but it does show a material decline in values, amounting to over $79,000,000. It is a noteworthy fact that the mineral production alone, while almost one-third greater in value that the metal product, decreased only one-half as much. Of the total decrease, over $30,000,000 was in the decreased production and shrinkage of values in pig iron; $9,000,000 was in coke and $6,000,000 in bituminous coal, both of which were largely due to the decline in pig iron production. In silver the decrease in value amounted to $6,000,000. In but few cases was there any increase. Anthracite coal gained $4,000,000 in value, thus partly offsetting the decline in bituminous, and gold increased $3,000,000. The figures clearly show the solid foundation upon which the country's prosperity is based, and its stability.

"The growth of the mineral industry of the United States has been so rapid as to be wholly beyond comparison with any other nation. Fifty years ago this country began to take rank as one of the important producers. In 20 years it had won a position among the leading nations, and now it not only excels all others, but the value of its products is almost as great as the value of the combined output of Great Britain, France and Germany."

The chart just issued by David T. Day, Chief of Division of Mining Statistics, U. S. Geological Survey, shows the total value of metallic and non-metallic mineral products of the United States in 1892 to be $688,687,712, instead of $724,821,009, as in the figures quoted above; for 1893 a value of $609,817,495, instead of $645,084,730 as above.

THE new steel freight steamer, "Kearsage," was launched at the yards of the Chicago Ship Building Co., at South Chicago, last week Thursday. The "Kearsage" will be employed in the grain trade between Duluth and Buffalo, under the management of her owners, the Inter-Lake S. S. Co. The dimensions are: length on keel, 328 feet; beam, 45 feet; and depth, 27 feet. The draft of water can be 20 feet as soon as the 20-foot channel through the lakes is completed. The engines are triple expansion 20, 36 and 52 inches in diameter by 40 inches stroke. There are two boilers, each 14 feet long by 13 feet in diameter. The wheel is 13 feet diameter with 16 feet pitch. All the machinery is furnished by the Cleveland Shipbuilding Co. The boat is built on the "channel" type of construction, and carries two pole spars. She will have a carrying capacity of about 3,000 tons.

ARMOR plate investigation is on at Washington.

STRUCTURAL CHANGES IN WROUGHT IRON.

BY HOWARD STILLMAN, SACRAMENTO, CAL.

The matter of structural change in wrought iron caused by torsion and twisting is but one of other means by which an altered structure may be produced. The object of this paper is to present the subject as it occurred to the writer in a practical way, and relates only to manufactured, rolled or fibrous wrought iron. I will first present facts, and afterward attempt to give the reason why of the phenomena of structural change based, of course, on known physical laws.

Some time since the question of adding tensile strength to wrought iron bars by twisting them was suggested, and various were the opinions advanced. Several tests were made with bars twisted hot and cold to prove or disprove the statements, care being taken in these first tests not to twist them enough to upset the fiber—a very necessary condition, as was afterward shown. Nothing came of these first attempts until the suggestion was made that they should be twisted cold as much as they would stand, when results were obtained that put a new light on the matter, and led to a series of tests being made with merchant bar iron twisted at or near its limit of torsional strength. Accordingly, a number of bars of one inch square iron were taken from the same run of rolling mill, being known as merchant bar, and rolled from hammered scrap slabs. For testing, the bars were cut into 24-inch lengths and milled to ⅞-inch square at the center, leaving a test section ⅞-inch square and one foot long, with 6 inches at either end to twist by, also to grip in pulling. The object in having a test section one foot long was to insure a stated number of twists per foot in length.

It is evident that in twisting a given bar the portions farthest from the center will travel most and be subject to a degree of extension depending on the distance from the center of the bar. The condition of the twisted bar will depend much on the nature of the material and its elasticity. A lack of homogeneity would therefore be expected at different diameters, and for tensile strength of twisted bars the cross section should not be diminished by the test-section common to tensile specimens. Figures per square inch can only be reliable for a homogeneous material when figured up from reduced sections, as is usually done. For these reasons no further reduction or "test-section" was made of the bars we have described as milled for 12 inches in middle by ⅞-inch square. Of these bars five were laid aside, the remainder twisted as follows:

A 30-inch lathe was provided with a square socket on the spindle and a similar one on the tool post. The tool carriage was thrown out of gear, and left free to move on the lathe bed should the bar draw or extend in twisting. The sockets were well oiled to further admit of movement lengthwise. The cold bars were then inserted, leaving the 12-inch milled section free to twist. The number of twists per foot were thus subject to actual measurement, and the lathe head was stopped at requisite turns, the same being necessarily in slow speed. The first bar twisted off at 2⅝ turns. The remaining bars stood each two turns without apparent flaw. No appreciable change in twisted length occurred. A contraction was looked for, but such was not the rule. After being thus twisted, the bars varied less than 1 per cent. in 12 inches, some in contraction and others in extension. Probably both occurred on either side of a neutral axis, having much to do with the structural change that occurred.

On the day following, both plain and twisted bars were pulled in the Olsen tensile machine of 200,000 pounds capacity.

A little time was given to allow the contracted fiber to set, as it were. Doubtless the length of this period would have affected results and the strength in one month would have varied from that in one year. The untwisted bars pulled in the usual manner, with no appearance unusual to ordinary wrought iron, being of requisite strength and proper ductility. The area where they parted showed a completely fibrous iron with the dull gray luster of a torn fiber. The twisted bars were somewhat of a surprise, as they showed much greater strength and broke with explosive violence. No reduction at the fractured area could be measured, and the elongation was extremely small. The elastic limit of these bars could not be determined, but must have continued almost to the point of rupture, which accounts for the violence with which the material parted. The broken section was completely crystalilzed and in no wise resembled the untwisted bars laid aside from the original number.

In the table the strength per square inch for twisted bars is not given, for the reasons previously stated, as such would express per square inch what could not occur for a square inch. It is evident that the amount of twist given a bar must depend on its size: small iron will stand more turns per foot than large. Experiments made with the same iron showed that one-inch square bars would not stand two turns per foot without twisting off.

Tensile tests of Merchant Bar Iron twisted to near its limst of torsion. All bars have test section of stated size, and one foot in length.

TESTPIECE.	Size bar.	Number of twists per foot.	Area before test.	Tensile strength.	Tensile strength per sq. in.	Per cent. elongation in 12 in.	Per cent. reduction of area.
	Inch.		Sq. in.	Lbs.	Lbs.		
No. 1	⅞ x ⅞	.....	76	39,200	51,202	21.87	30.39
No. 2	⅞ x ⅞	.....	76	39,950	52,181	22.92	36.91
No. 3	⅞ x ⅞	.....	76	40,400	52,770	21.87	27.58
No. 4	⅞ x ⅞	.....	76	39 820	52,012	23.95	37.81
No. 5	⅞ x ⅞	.....	76	39,510	51,999	22.92	36.00
Average	⅞ x ⅞	.....	76	39 836	52,033	22.71	33.74
No. 6	⅞ x ⅞	2⅝	Broke in twisting.				
No. 7	⅞ x ⅞	2	76	41.620	.....	2.58	1.12
No. 8	⅞ x ⅞	2	76	53,370	.....	Br. at clamps.	
No. 9	⅞ x ⅞	2	76	54 620	.....	Br. at clamps.	
No. 10	⅞ x ⅞	2	76	56,339	.....	4.00	3.41
No. 11	⅞ x ⅞	2	76	55,545	.....	2.92	5.51
Average	⅞ x ⅞	2	76	52.301	.....	3 17	3 35

SUMMARY OF AVERAGES.

Gain in tensile strength by twisting bar	31.28 per cent.
Loss in permanent elongation by twisting bar	86.15 per cent.
Loss in reduction at fractional area by twisting bar	90.07 per cent.

Other tests were made with iron of different sizes and number of twists per foot. The results were very similar to these stated, and a repetition here is hardly necessary.

It is shown that by twisting wrought-iron bars toward their torsional limit an increased tensile strength may be given them; the same being borrowed, as it were, at the expense of ductility.

A newly established molecular condition is set up and its grain may thus in a few moments be altered from a good fibrous ductile material to one thoroughly crystalline. The process may be said to age iron in a brief time, as when crystallized from age, assisted by vibration, it will exhibit much the same peculiarities, becoming harder, brittle and less reliable, therefore of doubtful value for engineering purposes. The structural changes in wrought iron can best be understood by a brief reference to certain laws of matter and the phenomena of crystallization.

All matter is made up of infinitely small particles, atoms or molecules, as they are called. These molecules obey certain fixed laws of attraction and repulsion in regard to each other, that are peculiar to the substance itself, and are dependent on outside conditions, as the degree of temperature. We may have a substance in solid, fluid or gaseous form depending on outside conditions whereby the relative coherence of the particles is changed. In liquid form the particles lose their coherence and are free to move among themselves. Reverse the conditions and the substance becomes solid. In passing from fluid to solid the molecules obey their common law and become coherent in the form of crystals, the many forms of which are known to the science of crystallography.

A discussion of this science is unnecessary here, but we have from its study an invariable rule, though it takes almost infinite forms, that in passing from a fluid to a solid state the molecules form or group themselves in certain shapes known as crystals, composing in the aggregate the substance itself. Now, while the laws of crystallization are general, we are apt to be deceived by what we mean as a fluid state. The definition of a fluid does not state how free the particles may be to move among themselves, and, therefore, we have different states of fluidity, as water, tar, lead and iron. Wrought iron is to a degree fluid, and we have produced crystallization in a few minutes within it by applying a considerable degree of force at right angles to the length of the bar and thus disturbing its molecules.

It remains for us now to briefly consider the manufacture of wrought iron. We know it to be a comparatively pure state of the metal produced by working and puddling the decarbon-

ized mass to free it from impurities, and that in a hot, plastic state it is then hammered or rolled. The effect of this working is to force the particles into an unnatural state instead of allowing them to set in crystalline form as nature had planned. They are squeezed and strung out, as it were, in filaments or threads and our product is a bar of fibrous iron. The particles will remain in this form if hammering or rolling is continued until the mass has cooled off below a white heat, otherwise they will take their natural shape, and the structure become crystalline. Many failures in ordinary blacksmith work have resulted from overheating as when in welding, the bar being heated to what approaches a welding heat too far back from where the iron is worked at the weld.

Heat does not seem to be a necessary condition of this structural change, as we have seen that we could twist a cold bar to such an extent as to induce the crystallization, or, in other words, cause the molecules to assume their natural or permanent state. The interlocking of this structure doubtless lends the increased tensile strength shown, and the loss of ductility would be naturally expected.

At best, we can consider fibrous wrought iron as but a temporary state of the metal. The crystallization of iron bridge rods, locomotive frames, straps or bolts, and steamship or other shafting, are but examples showing how slow structural change will occur—produced by small vibration or motion extended over long periods of time. The vibration of bridge rods or torsional power applied to shafting implies a motion among the molecules of the mass at right angles to their length, the effect of which will bring about the structural change to its permanent condition.

The examination of a piece of old broken wrought iron will show a coarse crystallization. In the case of our twisted bars, the crystallization is quite fine. This again shows a coincidence with known laws, as crystals when slowly formed are always larger than when quickly formed with the same substance.—[National Car and Locomotive Builder.

National School of Electricity.

The prospectus of The National School of Electricity, of Chicago, has been received. This school, which is in effect a practical system of instruction in modern electricity by means of local classes, is an outgrowth of the lectures on electricity which were given for a time during the World's Fair by the Chief of the Department of Electricity, and which were only discontinued because of the lack of a hall large enough to accommodate the audiences. It is the intention of the originators of the school to organize a class in electricity in every city where the population will justify it, and to provide thorough instruction under a system that will make the study of electricity not only interesting but of great commercial value to the students. The study will be conducted in the simplest manner possible. The officers of the school are: J. P. Barrett, Chief of the Electrical Department at the World's Fair, and Chief Electrician for the City of Chicago, president; J. L. Little, vice-president; J. Allan Hornsby, secretary, and E. L. Powers, of *Electrical Industries*, treasurer. The honorary faculty embraces such well-known men as Thomas A. Edison, Dean; Nikola Tesla; Prof. Henry S. Carhart, Dr. Elisha Gray, Prof. Harris J. Ryan, and several others equally high in their profession.

THE New Era Iron Works have been incorporated at Dayton, O., with a capital of $50,000, to manufacture gas engines and iron specialties. Their engine, the "New Era," has been in successful operation for nearly two years. It will be built principally in the larger sizes, and especial attention will be given to its construction for private electric light plants. V. P. Van Horne is president of the company, L. M. Johnston, vice-president, and A. M. Sullivan, secretary and treasurer.

CAYWOOD & RITTER, with offices at 1120 The Rookery, Chicago, have accepted the agency of the Brightman Stoker Co., of Cleveland, O., sole manufacturers of the celebrated Brightman mechanical stoker, a machine that has become thoroughly well known under the legend "the best boiler in the world." This machine is said to be a great economizer of soft coal, and a practical preventer of chimney smoke.

INDUSTRIAL SUMMARY.

New Enterprises:—

The following recent incorporations, specially reported for *The Iron Trade Review*, are of interest to the iron and machinery trades:

Kewaunee, Wis.—The Kewaunee Iron Works Co.; capital, $7,000; for general foundry and machine shop business; incorporators: W. Heck, A. Kacerofsky, W. Hossel. Address letters care of Jno. Wattawa, Kewaunee, Wis.

Chicago, Ill.—Lyman Wind Mill & Power Co.; capital, $50,000; for the manufacture and sale of wind mills and engines, and all things for the completion thereof; incorporators: Horace C. Lyman, Jas. Heckman, Chas. C. Carnahan. Address letters care of Heckman & Carnahan, 125 LaSalle st., Chicago, Ill.

Boyertown, Pa.—The Union Mfg. Co.; for the manufacture of iron or steel or both, or of any article of commerce from metal, wood or both; incorporators: Jno. Sabold, Thos. J. B. Rhoades, Milton R. Strunk, Boyertown, Pa. Address letters care of L. P. G. Fegley, Boyertown, Pa.

Chicago, Ill.—Schoonmaker S. M. Attachment Co.; capital, $9,000; for the manufacture and sale of sewing machine attachments and other articles; incorporators: Bronson Schoonmaker, Jno. D. Schoonmaker, H. C. Gage. Address letters to Schoonmaker S. M. Attachment Co., 17 S. Jefferson st., Chicago, Ill.

Chicago, Ill.—Metal Reduction Co.; capital, $10,000; to deal in iron and other metals, and to refine and galvanize the same, and to make metal castings and finish the same; incorporators: Jno. G. Campbell, Henry A. Ritter, Edw. S. Elliott. Address letters care of Defrees, Brace & Ritter, Home Ins. Bldg., Chicago, Ill.

Pittsburg, Pa.—The Pittsburg Automatic Lightning Co.; capital, $10,000; for the manufacture of iron or steel or both, or of any article of commerce from metal or wood or both; incorporators: H. W. McIntosh, Wilkinsburg, Pa.; Wm. Kaufman, Allegheny; Lawrence Woelfel, Bellevue, Pa. Address letters care of Wm. Kaufman, 110 Diamond St., Pittsburg, Pa.

Jersey City, N. J.—The Wheeler Compound Wire Co. (incorporated in W. Va.); capital, $500 min., $5,000,000 max.; for making, stamping, selling, etc., wire and wire rods, etc.; incorporators: Elbridge Wheeler, New York City, N. Y.; Robt. F. Brooke, Brooklyn, N. Y.; Thos. D. Conyngham, New York City, N. Y. Address letters care of Jno. H. Rice, 225 Washington Bldg., New York City, N. Y.

Auburn, Ind.—Auburn Mfg. Co.; capital, $20,000; for manufacturing and repairing articles in wood and metal; buy all materials therefor, purchase, erect and hold all necessary real estate, buildings, machinery, tools, etc.; incorporators: Chas. Eckhart, Jno. W. Baxter, E. T. Zimmerman, J. D. Leighty, Geo. A. Bishop, H. C. Shull, S. M. Nickey. Address letters care of Jno. W. Baxter, Auburn, Ind.

Jersey City, N. J.—The Wheeler Marine Shafting & Forging Co. (incorporated in W. Va.); capital, $500 min., $5,000,000 max.; for manufacturing, making, stamping, etc., all kinds of marine shafting, including tubular steel surface gun tubes, etc.; incorporators: Elbridge Wheeler, New York City, N. Y.; Robt. F. Brooke, Brooklyn, N. Y.; Thos. D. Conyngham, New York City, N. Y. Address letters care of Jno. H. Rice, 225 Washington Bldg., New York City, N. Y.

New Construction:—

Orr & Sembower, of Reading, Pa., are building a foundry. Heretofore they have purchased their castings.

An erecting shop for the Pittsburg Locomotive & Car Works, Allegheny, Pa., is under construction by the Pittsburg Bridge Co.

The Baltimore City Passenger Railway Co., Baltimore, Md., are about to erect extensive car repair shops in South Baltimore.

Chapman & Noble, of North Baltimore, O., have purchased land near Sutton, W. Va., on which to erect a wood-working plant.

The Harrison Safety Boiler Works, of Philadelphia, are preparing to build a new foundry in order to accommodate outside work.

The newly incorporated Novelty Iron Works, of Clinton, Ia.,

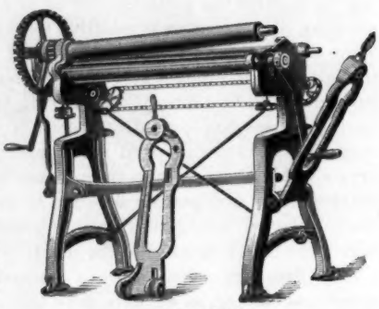
MACHINES FOR WORKING SHEET METAL

Patent Gap Shears.

Patent Gap Shears, Especially designed for Squaring, Trimming and Slitting. 6 to 18 inch throat for Slitting Wide Sheets Complete for Tin or Iron to 14 gauge. Seven Styles of various lengths HAND AND POWER.

General Purpose Punch and Shear. Seven Sizes.

Rear Side.



Forming Rolls.

General Purpose Forming Rolls, all sizes. Quickly adjusted and instantly opened—A Revolution. Also Patent Crimping Rolls. Beware of Infringements.

BERTSCH & CO., Cambridge City, Ind.

THE CARDEN CITY SAND CO., Suite 1015 Security Bldg, CHICAGO, ILL.

FIRE BRICK, FIRE CLAY,

For Blast Furnaces, Cupola Lining, Boiler Setting, Smoke Stack Lining, or Any Other Purpose.

EVERY CLASS OF SPECIAL SHAPES AND SIZES.

ALL KINDS OF

Foundry Supplies.

FACINGS, BLACKINGS AND MOULDING SANDS

Of All Kinds.

capital $25,000, are erecting a building with special facilities for handling heavy machinery. They will operate a foundry and machine shop.

A $200,000 plant is in contemplation by the Westinghouse Machine Co., who have secured 15 acres of land at Brinton Station, Pa., adjoining the site on which the Westinghouse Electric & Mfg Co.'s mammoth works are now going up.

The Racine (Wis.) Iron Co., whose works were recently destroyed by fire, have rebuilt on another site. The foundry is 60x100 feet and is well lighted. The machine shop and brass foundry are 60x80 feet, 2 stories high. Besides making iron and brass work, the company have facilities for nickel and bronze plating, tinning, japanning, etc.

Additions, Enlargements, Removals, Etc.:—

The Ohio Valley Railway Co. (office, Evansville, Ind.) will remove its DeKoven repair shops to Henderson, Ky. Plans for the new shops are now in the builder's hands.

The construction work on the new plant of the Detroit Foundry Equipment Co., at Harvey, Ill., is progressing rapidly. The work of moving their machinery from the Detroit works to the new plant will soon be commenced.

In connection with the changing of the Milwaukee Bridge & Iron Works into a corporation, additional buildings are to be put up, and the capacity considerably extended. R. G. Wagner, O. W. Wagner and W. J. Hahn are to be officers of the company.

The Baltimore Iron, Steel & Tin Plate Co. have concentrated their operations at Locust Point, securing a lease for three years on the plant of the old Coates rolling mills, at that place, with the option of purchase. Among the incorporators of the company are E. Rice Daniel and Robert Girvin, of Swansea, Wales. The officers are James E. Ingram, president; John M. Ingram, secretary, and Robert Girvin, treasurer and general manager.

Fires and Accidents:—

At Laconia, N. H., June 3, fire broke out in the paint shop of the Laconia Car Works and destroyed $100,000 worth of property. The paint shop, the foundry, the erecting shop and other buildings were consumed.

At Minneapolis the plant of R. R. Howell & Co., manufacturers of steam engines and farm machinery, was totally destroyed by fire June 2. The flames started in the boiler-room. Loss, $130,000; partly covered by insurance.

General Industrial Notes:—

No. 3 furnace of the Tennessee Coal, Iron & Railroad Co. will be relined.

The No. 1 furnace of the Carrie Furnace Co., at Rankin Station, Pa., was blown in June 1.

The Penn Iron & Coal Co., Canal Dover, O., have recently made improvements in their blast furnace.

The Beloit (Wis.) Iron Works Co. have increased their working time to 10 hours and added to their force

The Detroit Twist Drill & Chuck Co. have recently filled a large order for twist drills and chucks for Africa.

The Marshallton Iron Works, of Marshallton, Del., are busier than for several months and have taken on extra hands.

The Cummings Foundry Co., whose works are near Bridgeport, a suburb of Chicago, have started their new foundry plant.

The Akron Iron Co., Akron, O., J. A. Long receiver, have signed the scale of the National Finishers' Union for next year.

Both the Anniston and Hercules pipe works at Anniston, Ala., are resuming on full time, having long contracts for pipe ahead.

A record breaking 24-hour output at the Illinois Steel Co.'s furnace No. 7, at South Chicago, a short time ago, was 432 gross tons.

Moorhead, Brother & Co., Inc., of Pittsburg, have been able to keep their Vesuvius Iron & Nail Works at Sharpsburg, Pa., running steadily.

When the new blooming mill at the Duquesne Steel Works is completed the capacity will be from 1,200 to 1,600 tons of billets in 24 hours.

The Portsmouth Stove & Range Co., of Portsmouth, O., report sales for the first five months of '94 exceeding those for the same period in 1893.

The firm of James, Grant & Foote, of Chicago, has been organized with a capital of $18,000 for the manufacture of cut gearing and machinery.

Furnace C, of the Crane Iron Co., at Catasauqua, Pa., is the last of the group to blow out. It will be relined. Furnace E is being made ready for blast.

Two Isabella Furnace Co. stacks at Etna, Pa., have been making one-half their usual output since the coke strike began, and are likely to continue in blast.

The Solar Iron Works, at Pittsburg, were shut down Saturday, and the Black Diamond Steel Works ordered on half time for this week, on account of the coal famine.

The Schultz Bridge & Iron Co., Pittsburg, have just been awarded the contract by the city of Pittsburg, for two bridges over the B. & O. tracks at $23,571 and $33,075.

An additional mill will be put in operation soon, at the Ellwood Tin Plate Co.'s plant, at Ellwood, Pa., and the force increased from 150 to 200 men. Orders are coming in well.

The Pittsburg works of the Consolidated Steel & Wire Co., were put in operation, Monday, in the wire department, but for the present the rod mill will not run, as billets cannot be had.

At Johnstown, Pa., notices have been posted in various parts

MOUNT SAVAGE FIRE BRICK.

UNION MINING CO.,

Proprietors of the CELEBRATED Mount Savage Fire Brick.

GOVERNMENT ⁑ STANDARD.

Established 1841. Capacity, 60,000 Per Day; 18,000,000 Per Year.

The First Manufactory of its Kind in the U. S.

Home Office and Works:—MOUNT SAVAGE, Allegany County, Md.

Branch Offices:—No. 1 Broadway, New York, N. Y.; No. 222 So. Third St., Philadelphia, Pa.; Lewis Block, Pittsburgh, Pa.

Fire Brick.

High Grade Fire Brick for Melting. Heating and Blast Furnaces.

CUPOLA LININGS, BOILER SETTINGS AND ALL PURPOSES FOR WHICH FIRE BRICK ARE USED—ALL SHAPES.

Ground Clay in Bulk or Sacks. Send for list of shapes.

THE AMERICAN FIRE BRICK & CLAY CO., Mineral Point, Ohio.

When you write to firms advertised in our columns, please mention the fact that you took their address from our paper. They will thank you for it.

of the Cambria Iron Co.'s mechanical department that one-half of the employes will be suspended indefinitely as no coke can be obtained.

An unusual record of activity is that of the New Castle Wire Nail Works which have worked steadily for nine months without losing a turn day or night. Between 3,000 and 4,000 kegs are turned out every 24 hours.

Shipments have just been made by the Vulcan Iron Works, of Toledo, of two steam shovels to New York State, and one each to Wisconsin and Minnesota. These works have been running steadily the past year.

The Carondelet Foundry Co., of St. Louis, manufacturers of gray iron castings, are making improvements in their plant to increase their facilities. They have just adopted the Ridgway steam-hydraulic crane, made by Ridgway & Son, Coatesville, Pa.

The Ætna-Standard Iron & Steel Co., of Bridgeport, O., are about starting up their tin plate plant. They have three sets, two for tinplates and one for terne plates, and the estimated weekly capacity is 600 boxes of tin plates and 300 boxes of terne plates.

The Avery Stamping Co., of Cleveland, have one of the largest and most complete machine shops in the city and are prepared to do all kinds of machine and blacksmith work. They carry a stock of half iron and half steel material for cutting dies.

Dietz, Schumacher & Co., Cincinnati, have just received an order from the Lodge & Shipley Machine Tool Co., of the same city, for one of their 128-inch drill presses, the largest size. The demand for their Universal drill presses and engine lathes has been very encouraging.

In the recent letting of iron bridges to be built by the Big Four the coming year, 18 companies competed and the Union Bridge Co., of Buffalo got the contract, the erection work to be done by the railroad company. Bids on deck plate girders ranged from 1.90c. to 2.40c. f. o. b. cars.

The new Kansas City Steel & Iron Works have been secured by Argentine, Kas. A building formerly devoted to radiator manufacture will be occupied, and a force of 50 men employed in the manufacture of car couplings and other appliances. The company was located by citizens' subscriptions to its stock.

The Wetherald rolling mill at Frankton, Ind., now operated by the Northwestern Iron & Metal Co., of Chicago, has the advantage of abundant natural gas. It has five scrapping and three puddling furnaces, three heating furnaces, a 20-inch muck train and two finishing trains of rolls, one 10-inch and one 8-inch.

Youngstown, O., water works trustees have let the contract for the erection of two stand pipes to the Enterprise Boiler Co., at $17,495.36. Other bids were as follows: Reeves Bros., Alliance, $21,856.56; Stacy Mfg. Co., Cincinnati, $22,688; Wm. B. Pollock & Co., Youngstown, $24,227.04; Riter & Conley, Pittsburg, $21,800; Brownell & Co., Dayton, $16,682.

The Homestead Steel Works are profiting by the suspension of the Edgar Thomson plant. The gas mains that supply the latter works are extended to Homestead; thus while the suspension is on at the Braddock works a much greater pressure reaches the Homestead mill. Owing to this fact, very little coal is needed at Homestead, and the works can be operated steadily.

The Caldwell & Peterson Mfg. Co., the Wheeling Corrugating Co., Wheeling Boiler Co., Wheeling Wire Works and Spears & Riddle are all in operation, but hardly to full capacity. The coal and coke strikes with consequent curtailed business and collections hard to get, must have their depressing effects here as elsewhere; but taken altogether, Wheeling is more than holding her own as compared with other manufacturing districts.—[Ohio Valley Manufacturer.

After being out of blast about a year there is a good prospect for the Woodstock coke furnaces at Anniston, Ala., to be blown in shortly. A recent examination was made by an expert from Virginia to estimate the necessary cost of repairing not only the coke furnaces but also the charcoal furnace now standing, and to rebuild the one burned down in 1891. When the coke furnaces are in blast coke from the Coosa coalfield is used, which has been greatly improved, so that it now compares very favorably with other Alabama coke.

Improvements will be made at the American Iron & Steel Works, of Jones & Laughlins, Pittsburg, which will displace a large number of men. Three traveling cranes are to be installed in the No. 11 mill and hydraulic tables constructed. One crane will be for charging and drawing the iron into and out of the furnaces and conveying the heated piles to the rolls. The second will be in the straightening shop, employed to move the iron from one part of the shop to another. This will throw about 30 laborers out of work. The third traveling crane will hoist and remove the rolls when changes are made.

The Chicago Hard Copper Co., recently incorporated under the laws of Illinois, with headquarters at Chicago, capital stock $2,000,000, by John Moffitt, Chas. G. Tillman and Phil. V. Field,

is organized for the purpose of utilizing some recent discoveries for purifying, hardening and tempering copper. By the process used copper is so purified that castings made of it are free from blow-holes and are as solid as wrought steel. The copper is also rendered harder, and is so tempered that it can be bent into any form desirable without fracture, and is made much stronger and more durable. It is especially desirable for the manufacture of bells, some of which made by this process, are now in use by the North Chicago St. R. R. Co. Tests made of the treated metal at the Washington Navy Yard show it to be pure, and that the tensile strength is much greater than that of ordinary commercial copper.

Some of the amounts returned by Pittsburg iron and steel and kindred industries, as their gross business for the tax year are given below. A tax of ¼ mill is levied on these amounts: A. M. Byers & Co., $632,616; Crescent Steel Co., $597,000; W. W. Lawrence & Co., $300,000; Oil Well Supply Co., $400,000; J. Painter & Sons, $487,000; Riter & Conley, $585,900; Singer, Nimick & Co., $682,700; Clinton Iron & Steel Co., $315,000; A. Garrison Foundry Co., $408,694; Jones & Laughlins, $5,000,000; Carnegie Steel Co., $8,606,125; Dilworth, Porter & Co., $900,000; Moorhead Bros. & Co., $500,000; H. K. Porter & Co., $297,900; Pittsburg Forge & Iron Co., $100,000; Pittsburg Drop Forge Co., $100,000; Mackintosh, Hemphill & Co., $437,200; Shoenberger & Co., $2,052,000; Zug & Co., $427,600; Howe, Brown & Co., $550,000; Hainsworth Steel Co., $1,200,000; Thomas Marshall, $425,800; R. Munroe & Son, $300,000; Park Bros. & Co., Ltd., $2,048,000; Pittsburg Steel Casting Co., $112,000; Westinghouse Machine Co., $422,377; Keystone Rolling Mill Co., Ltd., $850,000; Linden Steel Co., $275,500; Moorhead, McCleane & Co., $219,000; Carbon Steel Co., $600,000; Siemens' Sleeth & Black, $385,500; Republic Iron & Steel Works, $650,000; Oliver Iron & Steel Co., $776,000; Oliver & Roberts Wire Co, $1,196,700; Westinghouse Electric Co., $4,000,000.

Seashore Excursion Over the Pennsylvania Short Lines.

Low rate round trip tickets to Asbury Park will be sold via Pennsylvania Short Lines July 7, 8 and 9, account National Educational Association meeting. Asbury Park adjoins Ocean Grove, Long Branch, Cape May, Atlantic City, Elberon, Sea Isle Park, Barnegat and other delightful watering places on the New Jersey coast, to all of which the Pennsylvania Lines form the only route comprised by one railway system. Return limit on excursion tickets will be ample for side trips. For any desired information apply to nearest Ticket Agent of the Pennsylvania Lines, or address F. Van Duzen, Chief Assistant Passenger Agent, Pittsburg, Pa.

Reduced Rates to Dayton via Pennsylvania Lines.

June 20th, excursion tickets to Dayton will be sold from ticket stations on the Pennsylvania Lines in Ohio, account the meeting of the Ohio Association of Union ex-Prisoners of War. Return coupons valid until June 21st, inclusive.

Dawson & Goodwin,

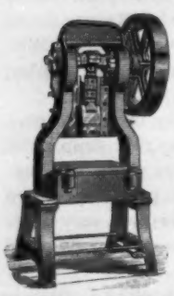
57 S. Canal St., CHICAGO,

DEALERS IN

NEW AND SECOND-HAND

MACHINE TOOLS.

We carry in stock a full line of



Engine Lathes,
Iron Shapers,
Iron Planers,
Drill Presses,
Milling Machines,
Turret Machinery.

☞Write for catalogue and prices. 4

Business Opportunity

Wanted a man with from $15,000 to $20,000 to invest in a good paying manufacturing business, with or without active participation in the management. This business is open to full inspection, and is old and well-established, with a good paying trade.

Address Box 202,

IRON TRADE REVIEW,

1141 Monadnock Blk,

CHICAGO.

UNION ELECTROTYPE FOUNDRY

TELEPHONE 2129

829 SHERIFF ST. CLEVELAND O.

FUEL ECONOMY. SMOKE PREVENTION

IF YOU WANT TO KNOW ALL ABOUT THE VERY BEST FURNACE IN THE WORLD FOR ANY STEAM BOILER

Send for Illustrated Descriptive Pamphlet ON MECHANICAL STOKERS FREE

THE BRIGHTMAN STOKER CO.

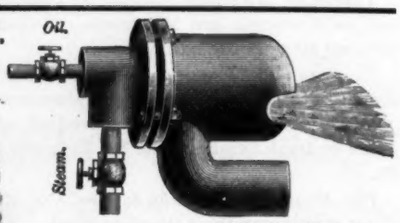
CLEVELAND OHIO.

THURMAN FUEL OIL BURNER CO.

Gen'l Offices, 35 and 36 Cordova Bldg., INDIANAPOLIS, IND.

Acknowledged the best for Boilers, Forges, Furnaces, Ovens, etc. Write for Catalogues.

BURNER NO. 6.



BURNER NO 4.

E. A. BOLDT, Sole Agent, Eastern States, 320 and 322 Broadway, New York, N. Y.

J. POWER HELY, Chicago Manager, 1405 Monadnock Block, Chicago, Ill.

NOTE.—If you are using oil as fuel, and are not getting good results, we would be pleased to send you our burners on trial. The oil in our burners can be atomized by either steam or air.

EAGLE BRAND THE BEST.

NO TAR. **ROOFING** NO TAR.

It is superior to any other roofing, and unequaled for House, Barn, Factory, or out-buildings; it costs half the price of shingles, tin, or iron; it is ready for use and easily applied by any one; it is the best roofing in the market, in durability, to all others. Send for estimate, and state size of roof.

RUBBER PAINT.

The best known paint in the world for tin, iron or shingle roofs, fences, sides of barns and out-buildings. It costs only 60 cents per gallon in barrel lots, or $4.50 for a 5-gallon tub. Color, dark red. It will stop leaks in tin or iron roofs that will last for years. It is guaranteed not to peel, crack, scale, nor wash off and is fire-proof against sparks. TRY IT.

EXCELSIOR PAINT & ROOFING CO.

155 Duane Street, New York, N. Y.

Ohio Excursion Rates via Pennsylvania Lines in June.

To Delaware, June 24th and 25th, for the Teachers' Association meeting. Return coupons valid until June 30th, inclusive.

To Akron, account State Epworth League meeting, June 25th and 26th, good to return until June 29th, inclusive.

For particulars and time of trains, apply to nearest Pennsylvania Line Ticket Agent.

AN edition of the souvenir maps of the Y. P. S. C. E. Convention to be held July 11th to 15th, at Cleveland, O., has been issued to the Nickel Plate Road, the shortest through passenger line between Buffalo and Chicago. Any person who expects to attend this convention and desiring one of these maps can have it forwarded to his address free, with the compliments of this low rate line. Requisition should be made on the Advertising Department of the Nickel Plate Road, Cleveland, O. B. F. Horner, General Passenger Agent.

THE Pope Mfg. Co. have just decided to remove their offices from Boston to Hartford, Conn., believing that the business can be better handled direct at the factory than at long range. The new office building to be erected at Hartford will cost $50,000. In 1888, the Pope Mfg. Co. employed 253 men and had about 100,000 square feet of floor space. Including the rubber works absorbed since and the tube department which has been added, they now have nearly eight acres of flooring or four times as much as in 1888. Employment is now given to nearly 1,200 men.

THE effect of the coal strike and business depression is apparent in the reports of coal shipments of the Pennsylvania railroad for the week ending May 26. These are for shipments east of Pittsburg and Erie: Coal, tons, 91,377; coke, tons, 15,836; total tons, 107,213. Total for year to May 26, 5,907,236 tons; to same date last year, 8,430,734 tons.

Bucyrus Steam Shovel & Dredge Co.,

—MAKERS OF—

STEAM SHOVELS — In Five Sizes for Railroad and Contract Work, Brick Yards, Stone Quarries, Stripping and Handling Iron Ore, Coal, Etc.

STEAM DREDGES — Of All Types and Sizes; for All Purposes; Elevator, Dipper, Clam Shell, Suction. Special Machines for Special Work.

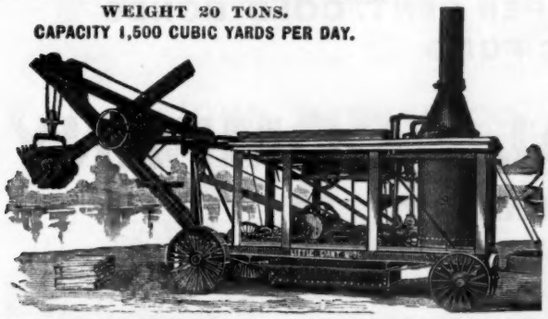
WRECKING CARS — BOTH HAND AND STEAM. CAPACITIES 10 TO 35 TONS.

PILE DRIVERS — WITH EITHER DROP OR STEAM HAMMERS.

SOUTH MILWAUKEE, WIS., or BUCYRUS, OHIO.

The "Little Giant" Excavator.

WEIGHT 20 TONS.
CAPACITY 1,500 CUBIC YARDS PER DAY.



The only Traction Shovel on the market, and nothing approaches it for general purposes.

VULCAN IRON WORKS CO., TOLEDO, O., U. S. A.

MANUFACTURERS OF
Dredges and Excavators.
Write for Photographs and Descriptive Matter.
RAILROAD CASTINGS.

There is no Steam Shovel on the market so well adapted to handling Iron Ore as our "Giant." We guarantee 2,500 tons in 10 hours.

SPECIALTIES:
Am. Crusher and Am. Ball Pulverizer.

THE AMERICAN MINING & MILLING MACHINERY CO.,

29 Euclid Ave., CLEVELAND, O. 280 Caxton Blk., CHICAGO, ILL.

The Simplest, Cheapest and Best Machines in the Market. Pulverize wet or dry to any degree of fineness. Makes little or no slimes in wet nor dust in dry work. Four sizes, capacity from 2 to 60 tons per day.

SEND FOR CATALOGUE.
Cable Address, American.

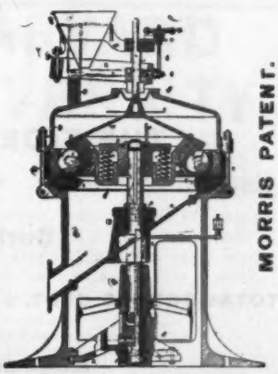
First Prize and Gold Medal Awarded by World's Fair, 1893.

Office of THE CLEVELAND IRON ORE PAINT CO. and THE GARRY IRON ROOFING CO.,
CLEVELAND, O., Jan. 25, 1894.

The American Mining & Milling Machinery Co., Cleveland, O.:

GENTLEMEN: We purchased a No. 2 American Rock Breaker and a No. 2 American Ball Pulverizer from your company about one year ago. The latter part of April, 1893, we started up for regular work, since which time we have run both of said machines to the full extent of our demands and to our entire satisfaction. The first 700 tons of hard iron ore that we pulverized for paint purposes was ground without taking the Pulverizer apart, and without expending one dollar for repairs for either of these machines. Of the 700 tons spoken of, about 200 tons was Lake Superior Specular iron ore, containing some 70 per cent. iron; a very difficult ore to pulverize. The remainder was a red fossiliferous iron ore, carrying quite a per cent. of silex, which cuts out buhr-stones rapidly. We find that the steel balls, which were when new 5 in. in diameter, now caliper 4⅞ in., and are perfectly round and smooth. The grinding track shows very little wear, and the driving track shows LESS; in fact, the wear is almost imperceptible. These two machines crush and pulverize more than one ton per hour with LESS than 12 H. P. We do not know of any Crusher or Pulverizer that can compare with the output of these two machines in quantity, quality, small amount of wear and tear, and like power. In our opinion, you cannot recommend them too highly. Very truly yours,

CLEVELAND IRON ORE PAINT CO.



THE AM. BALL PULVERIZER.

MORRIS PATENT.

J. J. THOMAS, Sup't. ..... D. D. DAVIS, Mgr.

OAK HILL FIRE BRICK & COAL CO., MANUFACTURERS OF

SUPERIOR FIRE BRICK
Of all Shapes and Sizes.
GROUND CLAYS A SPECIALTY.
Oak Hill, Ohio.

TELEPHONE 1916
ECLIPSE MUSIC PLATES
ELECTROTYPE ENGRAVING CO.
58 FRANKFORT ST. CLEVELAND.

FIRST MORTGAGE 15-YEAR SIX PER CENT. GOLD BONDS
WITH SINKING FUND
OF THE

BLUE RIDGE IRON COMPANY

OF VIRGINIA.

BLUE RIDGE IRON COMPANY. } CONSOLIDATED.
CRESCENT IRON COMPANY. }
LILY AND CRESCENT MINES.

Dated March 31st, 1894. Due April 1st, 1909.
Interest Payable April and October.

GUARANTEED TO APRIL 1st, 1899
—BY—
THE FIDELITY AND DEPOSIT COMPANY OF MARYLAND,
TRUSTEE FOR BONDHOLDERS.

Both Principal and Interest payable in Gold Coin at the office of the Trustee, Baltimore, Md.

TOTAL BONDED DEBT, $50,000.00. **CAPITAL STOCK, $300,000.00.**

GENERAL OFFICES: EQUITABLE BUILDING, BALTIMORE, MD.
Mines and Local Offices: Stanley, Page Co., Va.

Bonds Issued to Improve Mines and Increase Output.
OVER 1,000,000 TONS, ESTIMATED, HIGH-GRADE BROWN HEMATITE ORE.

N. & W. Ry. at Mines, Connecting Direct to the Great Iron and Steel Manufacturing Centres of Virginia, Pennsylvania, Ohio and Maryland. For Prospectus and Description, with Expert Analysis of Ores, Address

ANDREW MAYER,
Investment Banker, 18 Wall St., NEW YORK CITY.

FIRST MORTGAGE 25-YEAR SIX PER CENT. GOLD BONDS
WITH SINKING FUND
OF THE

BANCROFT COAL COMPANY

OF WEST VIRGINIA.

Dated March 31st, 1894. Due April 1st, 1919.
Interest Payable April and October.

GUARANTEED TO APRIL 1st, 1899
—BY—
THE FIDELITY AND DEPOSIT COMPANY OF MARYLAND,
TRUSTEE FOR BONDHOLDERS.

Both Principal and Interest payable in Gold Coin at the office of the Trustee, Baltimore, Md.

TOTAL BONDED DEBT, $75,000.00. **CAPITAL STOCK, $100,000.00.**

Mines and Offices: BANCROFT, PUTNAM COUNTY, WEST VIRGINIA.

Six hundred acres; 5 ft. Average Thickness of Coal; 2,250,000 tons Famous Kanawaha Coal.
Bonds Issued to Improve Property and Increase Output, exclusively.
Present Output, 250 tons per day. Water Transportation to Limitless Markets.
Send for Prospectus, and full Description and Report of Mines.

ANDREW MAYER, 18 Wall St., New York City.

JESSOP'S STEEL —FOR— Tools, Drills, Dies, etc.

Established over a Century ago. Manufactory, SHEFFIELD, ENGLAND.
CHIEF AMERICAN OFFICE, 91 JOHN ST., NEW YORK.
WM. JESSOP & SONS, Limited.
"Medal—World's Columbian Exposition, 1893."
All sizes carried in stock by The W. Bingham Co., Cleveland, Ohio.

CRUCIBLE STEEL CASTINGS

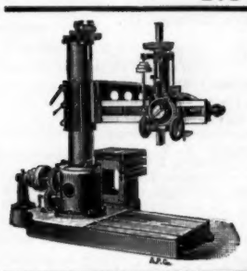
WHY?

Why send your **PATTERNS EAST** and wait **FOUR WEEKS** for your **CASTINGS** when you can get

SOLID STEEL CASTINGS

at home **PROMPTLY.**

ANSWER THE KING & ANDREWS CO.,
218 N. UNION ST., CHICAGO, ILL.



BICKFORD DRILL & TOOL CO.,
351 Pine St., Cincinnati, O.
BUILDERS OF
UPRIGHT, RADIAL, UNIVERSAL
RADIAL, MULTIPLE,
DRILLS.
BORING AND TURNING MILLS.

BARNES'
Upright Drills

Complete line ranging from our New Friction Disk Drill, for light work, to 42-inch Back Geared Self Feed Drill.

Send for Catalogue and Prices.

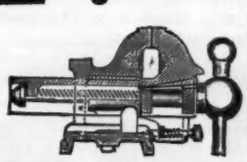
BARNES' WATER EMERY TOOL GRINDER

Has no pumps, no valves. No piping required to supply it with water. Always ready for use. Simplest in construction, most efficient in operation. Send for Catalogue and Prices. 2

W. F. & JOHN BARNES CO., 191 Ruby St., Rockford, Il.

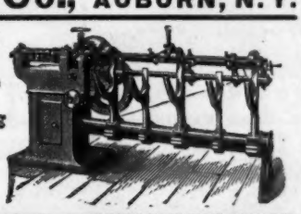
VISE.

Patented Dec. 27, 1892.
IT HAS QUALITIES THAT ARE UNDISPUTED.
Rapid, Active, Prompt.
One movement in and out, one turn of the hand and the work is secured.



The Capital Machine Tool Co., AUBURN, N.Y.

JOHN ADT & SON,
New Haven, Conn.
Builders of Machinery for Hardware Manufacture.
Automatic Wire Straightening and Cutting Machines, Butt Milling Machinery, Butt Drilling Machinery, Riveting Machines, Foot Presses, Screw Cutters, Etc.



POWER. MATERIAL.

Cheap Power, Desirable and Low-priced Labor, Abundant Supply of Raw Material and Market Facilities, are items always considered by Practical Manufacturers. The territory reached by the Baltimore and Ohio Railroad offers every advantage in the above, and manufacturers seeking new locations will find it to their interest to examine the opportunities afforded along that line before locating elsewhere. We will be pleased to confer or correspond with corporations or individuals and will afford them all the information or assistance neccessary in securing the most desirable locations.

M. V. RICHARDS,
Land and Immigration Agent, B. & O. R. R.,
Baltimore, Md.

LABOR. MARKETS.

GEORGE PEMBERTON,
18 Broadway, - New York.

Mining, Mineral and Timber Lands.

Municipal Bonds, Farm and City Mortgages, Short Time Paper. Large Tracts of Florida Phosphates and Hammock Lands. Investment Securities of all kinds bought and sold on commission.

Correspondence Solicited.

SECOND HAND!

14x6 Ames Lathe, rise and fall carriage with chuck.
16x6 Prentiss Lathe, complete.
18x6 New Haven Lathe, screw feed.
15x6 Lodge & Davis Turret Lathe.
15x6 American Tool Co. Square Arbor Fox Lathe with slide rest and chuck.
16x16x4 ft. Pease Planer.
18x18x4 Putnam Planer.
24x6 Pease Planer.
36x36x12 Pease Planer.
No. 1 Cincinnati Universal Milling Machine.
1⅛" Pratt & Whitney Bolt Cutter.
10" New Haven Shaper.
60" Niles Boring Mill.
Two 4-spindle gang drills.
1" wire feed screw machines.
No. 2 Brown & Sharpe Plain Grinder.
Cutter & Reamer Grinder.
Pond Index Miller.
Lincoln Slab Miller.

The above machines are complete and in good order. Most of them are the same as new.
Send for Photos, descriptions, etc.
Agents for Cincinnati Milling Machine Co., Bickford Drill Co., Windsor Machine Co., L. W. Pond Machine Co., Nicholson & Waterman, Ferracute Machine Co. and other first-class manufacturers.

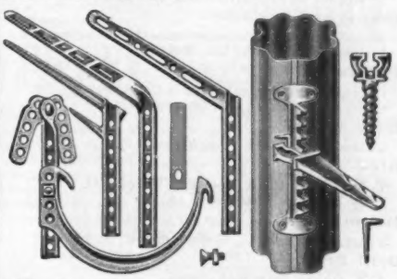
PRENTISS TOOL & SUPPLY CO.,
59 S. Canal St., Chicago.

FOR SALE.
Second-Hand Machinery
— FOR —
Machine Shops,
Foundries,
Boiler Shops,
Wood Shops.

If your wish to BUY or SELL, address

W. H. ROBERTSON,
54-60 S. Canal St., -:- CHICAGO, ILL.

BERGER BROS. TINNERS' HARDWARE and ROOFERS' SUPPLIES.



The best Eave Trough Hangers and Pipe Fasteners on earth. Berger's Long Eave Gutter. Pipe Hooks and Fasteners of every description. Also Ridging, Crestings, Finials, Registers and Ventilators. Don't buy until you have our price. Samples and catalogue free.

237 Arch St., PHILADELPHIA, PA.

HARVARD UNIVERSITY.

Lawrence Scientific School.

This School, which, together with the College and the Graduate School, is under the control of the Faculty of Arts and Sciences, offers eleven courses of study, each of four years' duration, leading to the degree of Bachelor of Science, viz.:

I. Civil Engineering.
II. Mechanical Engineering.
III. Electrical Engineering.
IV. Mining Engineering.
V. Architecture.
VI. Chemistry.
VII. Geology.
VIII. Botany and Zoology.
IX. Anatomy, Physiology and Physical Training.
X. General Course in Science.
XI. Course in Science for Teachers.

For further information, address

N. S. SHALER, Dean,
Cambridge, Mass.

ADVERTISE IN
THE IRON TRADE REVIEW.
Its readers are subscribers.

BUYERS' DIRECTORY OF IRON AND STEEL TRADES.

Analytical Chemists—
Cary & Moore, Chicago, Ill.
Dickman & MacKenzie, Chicago, Ill.
Hollis & Emmerton, Chicago, Ill.

Anti-Friction Metal—
Magnolia Anti-Friction Metal Co., New York.

Automatic Stokers.—
Brightman Stoker Co., Cleveland, O.

Blacksmith and Carriage Supplies—
Weber & Co., Cincinnati, O.
G. B. Schulte Sons Co., Cincinnati, O.

Blowers—
E. H. Jones & Co., Cleveland.
Brightman Stoker Co., Cleveland, O.
Buffalo Forge Co., Buffalo, N. Y.

Boilers and Boiler Attachments—
Babcock & Wilcox Co., New York.
Wm. B. Pollock & Co., Youngstown, O.
E. H. Jones & Co., Cleveland.
Brightman Stoker Co., Cleveland, O.
C. P. Adams, 807 Cuyahoga Bldg., Cleveland, O.
S. Freeman & Sons Mfg. Co., Racine, Wis.
Armstrong Bros., Springfield, O.
The J. C. McNeil Co., Akron, O.
Vulcan Iron Works Co., Toledo, O.
R. Laird & Son, Galion, O.

Bolts and Bolt Machinery—
Upson Nut Co., Cleveland.

Boring and Turning Mills—
Bickford Drill & Tool Co., Cincinnati, O.
H. Bickford, Lakeport, N. Y.
Dawson & Goodwin, Chicago, Ill.

Chain Belting—
Jeffrey Mfg. Co., Columbus, O.

Chemists—
Cary & Moore, Chicago, Ill.
Dickman & MacKenzie, Chicago, Ill.
Hollis & Emmerton, Chicago, Ill.

Chilled and Sand Rolls—
The Lloyd-Booth Co., Youngstown, O.
Wm. Tod & Co., Youngstown, O.

Coal and Coke—
W. J. Rainey, Cleveland, O.
P. J. & H. R. Pool, Cleveland, O.
Forster, Hawes & Co., Chicago, Ill.
C. K. Pittman, Chicago, Ill.

Consulting Engineers—
Richard A Parker, Marquette, Mich.
Artificial Gas Engineering Co., Pittsburg, Pa.

Cranes and Derricks—
Wm. Tod & Co., Youngstown, O.
Vulcan Iron Works Co., Toledo, O.

Cupolas—
Greiner Economical Cupola Co., Chicago, Ill.
Garden City Sand Co., Chicago, Ill.

Deck Engines—
Vulcan Iron Works Co., Toledo, O.

Dies—
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.

Dowel Pins—
Timmis & Clissold, Bound Brook, N. J.

Drill Presses—
A. P. Quint, Hartford, Conn.
Prentiss Tool & Supply Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
W. F & John Barnes Co., Rockford, Ill.
W. H. Robertson, Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
J. G. Timolat, 89 S. 5th ave., New York City.
Dawson & Goodwin, Chicago, Ill.

Drop Forgings—
The Billings & Spencer Co., Hartford, Conn.

Drop Presses—
Toledo Tool & Machine Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
Dawson & Goodwin, Chicago, Ill.

Eave Troughs and Conductors—
Berger Mfg. Co., Canton, O.
Berger Bros., Philadelphia, Pa.

Ejectors—
James Jenks, Detroit, Mich.

Emery and Corundum Wheels—
J. Wendell Cole, Columbus and Chicago.
Acme Safety Emery Wheel Co., Detroit, Mich.

Emery Wheel Machinery—
J. Wendell Cole, M. E., Columbus, O., or Chicago, Ill.

Engineers and Contractors—
E. H. Jones & Co., Cleveland.
Brightman Stoker Co., Cleveland, O.
Richard A. Parker, Marquette, Mich.
Artificial Gas Engineering Co., Pittsburg, Pa.
C. W. Hunt & Co., New York City.

Engineers' Specialties—
James Jenks, Detroit, Mich.

Engravers and Electrotypers—
Eclipse Electrotype & Engraving Co., Cleveland.
Union Electrotype Foundry, Cleveland.

Engines (Gas)—
Otto Gas Engine Works, Philadelphia, Pa.
Van Dusen Gas Engine Co., Cincinnati, O.
Newell Bros., Cleveland, O.
Buckeye Mfg. Co., Union City, Ind.

Engines (Steam)—
Wm. Tod & Co., Youngstown, O.
E. H. Jones & Co., Cleveland.
L. Spence & Son, Martins Ferry, O.
Brightman Stoker Co., Cleveland, O.
Wells Engine Co., New York City.
Armstrong Bros., Springfield, O.
The John T. Byers Machine Co., Ravenna, O.
R. Laird & Son, Galion, O.

Excavators—
Vulcan Iron Works Co., Toledo, O.

Exhaust Heads—
W. C. Lyman, Chicago, Ill.

Fans—
Buffalo Forge Co., Buffalo, N. Y.

Files, Makers of—
E. K. Morris & Co., Cincinnati, O.

Fillet—
Smith's Pattern Works, Akron, O.

Fire Brick and Clay—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Garden City Sand Co., Chicago, Ill.
Geo. H. Anderson & Co., Pittsburg, Pa.
Westmoreland Fire Brick Co., Pittsburg, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
American Fire Brick & Clay Co., Mineral Point, Ohio.

Foot and Power Lathes—
Prentiss Tool & Supply Co., Chicago, Ill.
W. F. & John Barnes Co., Rockford, Ill.
W. H. Robertson, Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
Dawson & Goodwin, Chicago, Ill.

Foundries—
Harn, Ow & Co., Beaver Falls, Pa.
Addyston Pipe & Steel Co., Cincinnati, O.
Radford Pipe & Foundry Co., Cincinnati, O.
Brightman Stoker Co., Cleveland, O.
The Lloyd-Booth Co., Youngstown, O.
Taylor & Boggis Foundry Co., Cleveland, O.
Wm. Tod & Co., Youngstown, O.
S. Freeman & Sons Mfg. Co., Racine, Wis.

Foundry Supplies—
Garden City Sand Co., Chicago, Ill.
Greiner Economical Cupola Co., Chicago, Ill.
American Fire Brick & Clay Co., Mineral Point, Ohio.
Timmis & Clissold, Bound Brook, N. J.

Forgings—
Cleveland City Forge & Iron Co., Cleveland.

Fuel Oil Burners—
John R. Armstrong Co., Chicago, Ill.
Thurman Fuel Oil Burner Co., Indianapolis, Ind

Furnace Linings—
Union Mining Co., Mt. Savage, Md.
American Fire Brick & Clay Co., Mineral Point, Ohio.
Garden City Sand Co., Chicago, Ill.

Friction Clutch Pulleys—
J. H. & D. Lake Co., Massillon, O.

Galvanizers—
H. H. Hodell, Cleveland.

Grindstones—
E. K. Morris & Co., Cincinnati, O.

Graphite Paint—
Jos. Dixon Crucible Co., Jersey City, N. J.

Hangers, Pulleys and Shafting—
J. H. & D. Lake Co , Massillon, O.

Heaters and Purifiers—
Stilwell & Bierce Manufacturing Co., Dayton, O.
E. H. Jones & Co., Cleveland.
Brightman Stoker Co., Cleveland, O
Warren, Webster & Co., Camden, N J.

Heavy Hardware—
E. K. Morris & Co., Cincinnati, O.

Hoisting and Conveying Machinery—
C. W. Hunt & Co , New York City.

Hoisting Engines—
Vulcan Iron Works Co., Toledo, O.
The John T. Byers Machine Co., Ravenna, O.

Injectors—
Eagle Lubricator Co., Cleveland, O.
James Jenks, Detroit, Mich.

Insurance Companies—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

Iron and Steel Wire—
Trenton Iron Co., Trenton, N. J.

Investments—
Frank R. Biedler, Baltimore, Md.
Fidelity & Deposit Co., Baltimore, Md.
Geo. Pemberton, New York.

Iron Nails and Steel—
Weber & Co., Cincinnati, O.
G. B. Schulte Sons Co., Cincinnati, O.
Geo. H. Sibell & Co., Chicago, Ill.

Iron Ore, Bar and Pig Iron—
Oglebay, Norton & Co., Cleveland.
J. H. Outhwaite & Co., Cleveland.
Condit-Fuller Co., Cleveland.
E. C. Pope, Cleveland.
Geo. H. Sibell & Co., Chicago, Ill.
Forster, Hawes & Co., Chicago, Ill.

Iron and Steel Roofing—
Sykes Iron & Steel Roofing Co., Niles, O.
Berger Mfg. Co., Canton, O.
Berger Bros., Philadelphia, Pa.

Iron Working Tools—
John Adt & Son, New Haven, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Cleveland Twist Drill Co., Cleveland, O.
Prentiss Tool & Supply Co., Chicago, Ill.
A. P. Quint, Hartford, Conn.
Toledo Machine & Tool Co., Toledo, O.
W. F. & John Barnes Co., Rockford, Ill.
H. Bickford, Lakeport, N. Y.
W. H. Robertson, Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
The Billings & Spencer Co., Hartford, Conn.
Dawson & Goodwin, Chicago, Ill.
Cincinnati Milling Machine Co., Cincinnati, O.

Land Companies—
Chicago Heights Land Association, Chicago, Ill.

Lathes—
Prentiss Tool & Supply Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
W. F. & John Barnes Co., Rockford, Ill.
W. H. Robertson, Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
Dawson & Goodwin, Chicago, Ill.

Link Belting—
The Jeffrey Mfg. Co., Columbus, O.

Machinists' Tools and Supplies—
Prentiss Tool & Supply Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O
W. F. & John Barnes Co., Rockford, Ill.
H. Bickford, Lakeport, N. Y.
W. H. Robertson, Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
Dawson & Goodwin, Chicago, Ill.

Machine Screws—
Illinois Screw Co., Chicago, Ill.

Machine Shops—
Toledo Machine & Tool Co., Toledo, O.
Harn, Ow & Co., Beaver Falls, Pa.

Mining Machinery—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O.
Vulcan Iron Works Co., Toledo, O.
American Mining & Machinery Co., Cleveland.
C. W. Hunt & Co., New York City.

Moulding Sand—
Garden City Sand Co., Chicago, Ill.

Municipal Bonds—
Frank R. Biedler, Baltimore, Md.

Milling Machines—
Prentiss Tool & Supply Co., Chicago, Ill.
W. H. Robertson, Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
Dawson & Goodwin, Chicago, Ill.
Cincinnati Milling Machine Co., Cincinnati, O.

Mines and Mining Stock—
Frank R. Biedler, Baltimore, Md.

Mining Engineers—
Richard A. Parker, Marquette, Mich.

Oil Tanks—
The J. C. McNeil Co., Akron, O.

Ore Crushers—
American Mining & Machinery Co., Cleveland

Paint—
Iron Clad Paint Co., Cleveland.
Jos. Dixon Crucible Co., Jersey City, N. J.
Berger Bros., Philadelphia, Pa.
Excelsior Paint & Roofing Co., New York.

Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago.
Hendrick Mfg. Co., Ltd., Carbondale, Pa.

Planers—
Prentiss Tool & Supply Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
W. H. Robertson, Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
Dawson & Goodwin, Chicago, Ill.

Plumbers' and Gas Fitters' Supplies—
Berger Bros., Philadelphia, Pa.

Portable Engines and Boilers—
Armstrong Bros., Springfield, O.

Portable Forges—
Buffalo Forge Co., Buffalo, N. Y.
Cady Mfg. Co., Cleveland, O.

Portable Drills—
J. G. Timolat, 89 S. 5th ave., New York City.

Power Hammers—
W. H. Robertson, Chicago, Ill.

Presses—
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.

Pulleys—
J. H. & D. Lake Co., Massillon, O.

Pulverizing Machinery—
American Mining & Milling Machinery Co., Cleveland, O.

Pumps (Steam)—
E. H. Jones & Co., Cleveland.
Brightman Stoker Co., Cleveland, O.

Radial Drills—
Bickford Drill & Tool Co., Cincinnati, O.
Railroad Castings—
Vulcan Iron Works Co., Toledo, O.
Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland.
Garden City Sand Co., Chicago, Ill.
Rock Breakers—
American Mining & Machinery Co., Cleveland.
Rolling Mill Machinery—
The Lloyd-Booth Co., Youngstown, O.
Roofing (felt)—
Berger Bros., Philadelphia, Pa.
Consolidated Roofing Works, Columbus, O.
Excelsior Paint & Roofing Co., New York.
Sand and Chill Rolls—
The Lloyd-Booth Co., Youngstown, O.
Saws—
Peter Gerlach & Co., Cleveland.
Schools—
Correspondence School of Mechanics, Scranton, Pa.
Scrap Iron & Steel—
Klein & Cohn, Cincinnati, O.
Screens for Coal Ore, Etc.
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.
Hendrick Mfg. Co., Ltd., Carbondale, Pa.
Screws—
Illinois Screw Co., Chicago, Ill.
Second-Hand Machinery—
Prentiss Tool & Supply Co., Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
W. H. Robertson, Chicago, Ill.
Dawson & Goodwin, Chicago, Ill.
Shearing and Punching Machinery—
Bertsch & Co., Cambridge City, Ind.
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Dawson & Goodwin, Chicago Ill.
Sheet Iron—
Cleveland Rolling Mill Co., Cleveland.
Berger Bros., Philadelphia, Pa.
Smoke Consumer—
Brightman Stoker Co., Cleveland, O.
Smokeless Furnaces—
Brightman Stoker Co., Cleveland, O.
Special Machinery—
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
Stamping and Punching—
Cady Mfg. Co., Cleveland, O.
Stand Pipes—
The J. C. McNeil Co., Akron, O.
Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insuranc Co., Hartford, Conn.
Steam Shovels and Dredges—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O.
Vulcan Iron Works Co., Toledo, O.
Steel—
Wm. Jessop & Sons, Ltd. New York, N. Y.
Steel Castings—
Chester Steel Casting Co., Philadelphia, Pa.
Wm. Jessop & Sons, Ltd., New York, N. Y.
King & Andrew Co., Chicago Ill.
Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.
Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland.
James Murdock, Jr., Cincinnati, O.
Stokers—
Brightman Stoker Co., Cleveland, O.
Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland.
Tanks—
S. Freeman & Sons Mfg. Co., Racine, Wis.
R. Laird & Son, Galion, O.
Tinners' Hardware—
Berger Bros, Philadelphia, Pa.
Tinning Machinery—
The Lloyd-Booth Co., Youngstown, O.
Tool Steel—
Wm. Jessop & Sons, Ltd., New York, N. Y.
Tramways—
Trenton Iron Co., Trenton, N. J.
Turret Drills—
A. P. Quint, Hartford, Conn.
Twist Drills—
Cleveland Twist Drill Co., Cleveland.
Valves—
Berger Bros., Philadelphia, Pa.
Vises—
Capital Machine Tool Co., Auburn, N. Y.
Ventilating Fans—
E. H. Jones & Co., Cleveland.
Brightman Stoker Co., Cleveland, O.
Washers—
Milton Mfg. Co., Milton, Pa.
Water, Gas and Steam Pipe—
Addyston Pipe & Steel Co., Cincinnati, O.
Radford Pipe & Foundry Co., Cincinnati O.
Well Drilling Machinery—
Williams Bros., Ithaca, N. Y.
Wire Fence Ratchets—
J. Stauffer, Dayton, O.
Wire Rope—
Trenton Iron Co., Trenton, N. J.
Wire Machinery—
John Adt & Son, New Haven, Conn.
Cady Mfg. Co., Cleveland, O

FOR
ARTISTIC
PRINTING
WRITE
THE
CLEVELAND
PRINTING &
PUBLISHING CO.,
CLEVELAND, O.

"THE IRON TRADE REVIEW"

is an increasingly valuable medium through which to sell equipment to machine shops and foundries.

THE S. T. W. EJECTOR.

SIMPLEST, BEST and CHEAPEST PUMP made.

SEND FOR CIRCULAR.

James Jenks,
199 JEFFERSON AVE,
Detroit, Mich.

The Advertiser who sticks to printer's ink in dull months will find trade sticking to him when the turn comes.

Cleveland Union Station.

Pennsylvania Lines.

Foot of Bank Street.

TICKET OFFICES at Station, Euclid Av., Woodland Av., and Weddell House corner.

THROUGH TRAINS RUN AS FOLLOWS BY CENTRAL TIME
* Daily. † Daily, except Sunday.

FROM CLEVELAND TO	LEAVE	ARRIVE
Pittsburgh and Bellaire	† 7.45 am	†11.55 am
Pittsburgh, Bellaire and East	†12.45 pm	† 6.25 pm
Philadelphia and New York	* 1.40 pm	*11.15 am
Baltimore and Washington	* 1.40 pm	*11.15 am
Alliance and Pittsburgh	* 1.40 pm	*11.15 am
Ravenna and Alliance	† 3.25 pm	† 9.50 am
Hudson and Ravenna	* 5.10 pm	* 8.15 am
Philadelphia and New York	*11.10 pm	* 5.25 am
Baltimore and Washington	*11.10 pm	* 5.25 am
Alliance and Pittsburgh	*11.10 pm	* 5.25 am

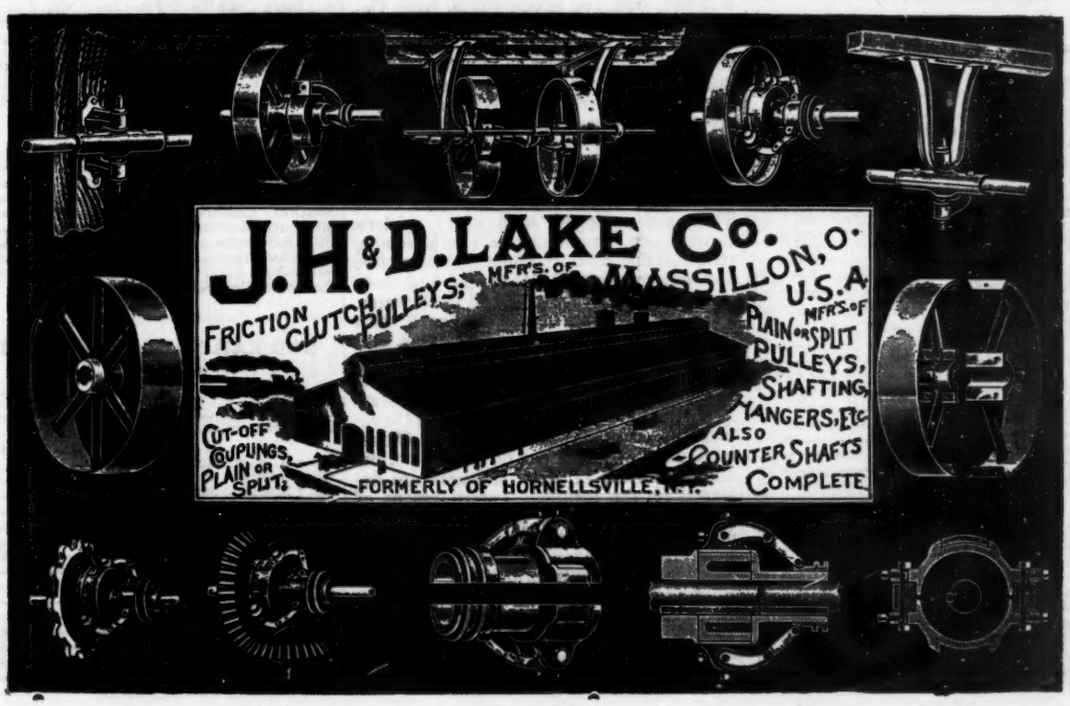
Mt. Vernon and Pan-Handle Route.

FROM CLEVELAND TO	LEAVE	ARRIVE
Xenia and Cincinnati	* 8.40 am	* 5.15 pm
Akron, Columbus & Zanesville	†12.45 am	*11.55 pm
Akron and Columbus	* 8.40 pm	*5.15 pm
Akron and Orrville	† 3.25 pm	† 9.50 am
Columbus and Cincinnati	* 8.00 pm	* 7.00 am

Valley Ry. Depot foot of So. Water St. City Office 143 Superior St.

	Arrive.	Depart.
Akron & Canton	*6:40 P M	*7:10 A M
Akron, Canton & Valley Jctn.	*10:10 A M	*3:15 P M
Valley Jctn. & Way Stations	†6:40 P M	†7:10 A M
Akron, Canton & Chicago	*8:00 A M	*6:30 P M
Wooster and Garrett	†3:00 P M	†11:00 A M
Wooster	.....	*6:30 P M
Akron, Canton & Marietta	†3:00 P M	†11:00 A M
Steubenville, Wheeling, Washington, D. C., and Baltimore	†3:00 P M	†11:00 A M

†Daily except Sunday. *Daily. Pullman's Palace Vestibule Compartment Sleeping cars between Cleveland and Chicago.


J.H. & D. LAKE CO.
MFR'S OF
MASSILLON, O. U.S.A.
FRICTION CLUTCH PULLEYS;
MFR'S OF PLAIN OR SPLIT PULLEYS, SHAFTING, HANGERS, ETC.
ALSO COUNTER SHAFTS COMPLETE
CUT-OFF COUPLINGS, PLAIN OR SPLIT.
FORMERLY OF HORNELLSVILLE, N.Y.

Alphabetical List of Advertisers.

The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks; the parallel (‖) three times out of four.

	PAGE
*Acme Safety Emery Wheel Co.	—
Adt, John & Son	19
Adams, C. P.	24
Aitchison, Rob't Perforated Metal Co.	23
American Fire Brick & Clay Co.	15
American Mining & Milling Machinery Co.	17
Anderson & Co., Geo. H.	1
Armstrong Bros.	28
Armstrong Mfg. Co., John R.	27
Artificial Gas Engineering Co.	2
Babcock & Wilcox Co.	28
Barnes Co., W. F. & John	19
*Berger Bros.	19
*Berger Mfg. Co.	—
Bertsch & Co.	14
Bickford Drill & Tool Co.	19
Bickford, H.	28
Biedler, Frank R.	25-27
Billings & Spencer Co.	2
Brightman Stoker Co.	16
Buckeye Mfg. Co.	2
Bucyrus Steam Shovel & Dredge Co.	17
Buffalo Forge Co.	1
Byers Machine Co., John F.	26
Cady Mfg. Co.	23
Capital Machine Tool Co., The	19
Cary & Moore	2
Chester Steel Casting Co.	24
Cincinnati Milling Machine Co.	1
Cleveland City Forge & Iron Co.	1
Cleveland Rolling Mill Co.	28
Cleveland Twist Drill Co.	28
Cleveland & Buffalo Transit Co.	27
*C. M. & St. P. Ry.	—
Cole, J. Wendell	28
Condit-Fuller Co.	26
Consolidated Roofing Works	28
Correspondence School of Mechanics	25
Dawson & Goodwin	16
Dickman & MacKenzie	2
Dixon, Jos. Crucible Co.	23
Eclipse Electrotype & Engraving Co.	17
Empire Paint & Roofing Co.	24
Excelsior Paint & Roofing Co.	16
Fay & Egan Co., J. A.	23
Fleharty, J. H. & Co.	26
Forster, Hawes & Co.	1
*Freeman & Sons Mfg. Co.	23
Garden City Sand Co.	14
Gerlach, Peter & Co.	26
Greiner Economical Cupola Co.	27
Harrington & King Perforating Co.	26
Hartford Steam Boiler Insp. & Ins. Co.	22
*Hendrick Mfg. Co., Ltd	22
Hill, Clarke Co	1
*Hodell, H. H. & Co.	—
Hollis & Emmerton	2
Hunt Co., C. W.	24
Illinois Screw Co.	1
Iron Clad Paint Co.	23
Jeffrey Mfg. Co.	27
Jenks, James	21
Jessop & Sons, Ltd., Wm.	19
Jones, E. H. & Co.	28
King & Andrews Co., The	19
*Laird & Son	—
Lake Co., J. H. & D.	21
Lawrence Scientific School	19
Lloyd Booth Co.	26
Long & Allstatter Co.	2
Lyman, W. C.	1
Magnolia Anti-Friction Metal Co.	1
Mayer, Andrew	18
McNeil Co., J. C.	25
Milton Mfg. Co.	28
Murdock, Jr., Jas.	28
Newell Bros.	1
†Oak Hill Fire Brick & Coal Co.	17
Oglebay, Norton & Co.	26
Otto Gas Engine Co.	26
Outhwaite, J. H. & Co.	26
Parker, Richard A.	27
Pemberton, Geo.	19
Pittman, C. K.	2
Pollock, Wm. B. & Co.	2
Pool, F. J. & H. R.	1
Pope, E. C.	26
Prentiss Tool & Supply Co.	19
Quint, A. P.	28
Rainey, W. J.	1
Richards, M. V.	19
*Robertson, W. H.	19
Robertson, E. C.	2
Robinson & Orr	2
Schantz, A. A.	22
‖Sharon Fire Brick Works	—
Shiffler Bridge Co.	25
Sibell & Co., Geo. H.	23
*Smith's Pattern Works	—
Spence & Son, J.	2
Stauffer, J.	24
Stilwell & Bierce Co.	2
Sykes Iron Roofing Co.	24
Taylor & Boggis Foundry Co.	1
Thurman Fuel Oil Burner Co.	16
Timolat, J. G.	25
*Timmis & Clissold	25
Tod, Wm. & Co.	26
Toledo Machine & Tool Co.	27
*Trenton Iron Co.	—
Union Electrotype Foundry	16
Union Mining Co.	15
Upson Nut Co.	26
Van Duzen Gas Engine Co.	2
Vulcan Iron Works	17
Warren, Webster & Co.	27
Wells Engine Co.	27
Westmoreland Fire Brick Co.	25
*Williams Bros.	25

PERFORATED SHEET METALS

OF EVERY DESCRIPTION,

FOR SCREENING PURPOSES.

THE HENDRICK MFG. CO., Ltd.,

CARBONDALE, PA.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treas.

BURWELL & BRIGGS, General Agents, 208 Superior Street, Cleveland, O.

C. A. BURWELL, Chief Inspector, 208 Superior St., Cleveland O.

‡ E. WOLCOTT, Special Agent, 96 4th Avenue, Pittsburgh, Pa.

SPEND YOUR OUTING ON THE GREAT LAKES.

Visit picturesque Mackinac Island. It will only cost you about $12.50 from Detroit; $15 from Toledo; $18 from Cleveland, for the round trip, including meals and berths. Avoid the heat and dust by traveling on the D. & C. floating palaces. The attractions of a trip to the Mackinac region are unsurpassed. The island itself is a grand romantic spot, its climate most invigorating. Two new steel passenger steamers have just been built for the upper lake route, costing $300,000 each. They are equipped with every modern convenience, annunciators, bath-rooms, etc., illuminated throughout by electricity, and are guaranteed to be the grandest, largest and safest steamers on fresh water. These steamers favorably compare with the great ocean liners in construction and speed. Four trips per week between Toledo, Detroit, Alpena, Mackinac, St. Ignace, Petoskey, Chicago, "Soo," Marquette and Duluth. Daily between Cleveland and Detroit. Daily between Cleveland and Put-in-Bay. The cabins, parlors and staterooms of these steamers are designed for the complete entertainment of humanity under home conditions; the palatial equipment, the luxury of the appointments, makes traveling on these steamers thoroughly enjoyable. Send for illustrated descriptive pamphlet. Address A. A. SCHANTZ, G. P. & T. A., D. & C. Detroit, Mich.

Subscribe for THE IRON TRADE REVIEW.

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

No. 1 Specular, Bessemer	3.00@ 3.35
No. 1 Bessemer hematite	2.75@ 0.00
Hematites No. 1 non-Bessemer	2.25@ 2.50
No 1. Specular, non-Bessemer	2.50@ 3.00

PIG IRON.

CLEVELAND (f. o. b. cars):	
Bessemer	$13 00@$00 00
No. 1 Strong Foundry	11 25@ 11 50
No. 2 Strong Foundry	10 25@ 10 50
No. 1 Gray Forge, red short	9 50@ 9 75
No. 2 Gray Forge, neutral	9 25@ 00 00
No. 1 American Scotch	11 60@ 00 00
No. 2 American Scotch	10 60@ 00 00
Lake Superior Charcoal	14 00@ 14 50
PITTSBURG:	
No. 1 Foundry	$11 25@$11 50
No. 2 Foundry	10 50@ 11 00
Gray Forge	9 25@ 9 50
White and Mottled	9 00@ 9 25
Warm Blast Charcoal	18 00@ 19 00
Cold Blast Charcoal	22 00@ 26 00
Bessemer	13 00@ 00 00
CHICAGO (reported by our representative:)	
Lake Superior Charcoal	$14 50@$15 00
Local Coke Foundry No. 1	11 50@ 12 00
Local Coke Foundry No. 2	10 50@ 11 00
Local Coke Foundry No. 3	10 00@ 10 50
Local Scotch Foundry No. 1	11 50@ 11 75
Local Scotch Foundry No. 2	10 75@ 11 25
Local Scotch Foundry No. 3	10 25@ 10 75
Southern Coke No. 1	10 75@ 11 00
Southern Coke No. 2	10 50@ 10 75
Southern Coke No. 3	10 25@ 10 50
Southern No. 1 Soft	10 50@ 10 75
Southern No. 2 Soft	10 25@ 10 50
Southern Silveries No. 1	11 50
Southern Silveries No. 2	11 00
Jackson Co. Silveries	15 00@ 16 00
Ohio Silveries No. 1	14 00@ 14 50
Ohio Silveries No. 2	13 00@ 13 50
Ohio Strong Softeners	12 50@ 13 50
Alabama Car Wheel	17 50@ 18 00
Southern Charcoal No. 1	14 50@ 15 00
Southern Charcoal No. 2	14 00@ 14 50
CINCINNATI (reported by Rogers, Brown & Co.)	
Southern Coke No. 1, Foundry	$10 25@$10 50
Southern Coke No. 2 and No. 1 Soft	9 25@ 9 50
Hanging Rock Coke, No 1	12 00@ 12 50
Hanging Rock Charcoal No. 1, Fdy	16 00@ 17 00
Tennessee Charcoal No 1	14 00@ 14 50
Jackson County Stone Coal No 1	14 50@ 16 00
Southern Coke, Grey Forge	8 75@ 9 00
" " Mottled	8 50@ 8 75
Standard Alabama Car Wheel	16 25@ 17 25
Tennessee " "	15 50@ 16 00
Lake Superior " "	16 00@ 16 50
BUFFALO (reported by Rogers, Brown & Co.)	
No. 1 Foundry Strong Coke Iron Lake Superior Ore	$11 50
No. 2 Foundry Strong Coke Iron Lake Superior Ore	11 00
Ohio Softener No. 1	11 50
Jackson Co. Silvery No. 2	15 50@ 16 50
Lake Superior Charcoal	14 75
Tennessee Charcoal	15 50
Southern Soft No. 1	11 00
Southern Soft No. 2	10 50
Alabama Car Wheel	16 00@ 17 50
Hanging Rock Charcoal	18 50
LOUISVILLE (reported by Geo. H. Hull & Co.)	
Southern Coke No. 1 Foundry	$10 25@$10 50
Southern Coke No. 2 Foundry	8 75@ 9 25
Southern Coke No. 3 Foundry	8 50@ 8 75
Gray Forge	8 00@ 8 50
Southern Charcoal No. 1 Foundry	12 50@ 13 50
Car Wheel	15 00@ 15 50
Spathite	11 25@ 11 75
ST. LOUIS (reported by Rogers, Brown & Meacham):	
Southern Coke No 1	$10 75@$11 00
Southern Coke No. 2	9 75@ 10 00
Southern Coke No. 3	9 50@ 9 75
Southern Gray Forge	9 00@ 9 25
Southern Charcoal No. 1	14 00@ 14 50
Missouri Charcoal No. 1	14 50@ 15 00
Ohio Softeners	14 50@ 15 00
Lake Superior	16 50@ 17 00
Southern	16 75@ 17 25
Connellsville Coke, St. Louis	4 50

OLD RAILS AND SCRAP METAL.

[Prices paid by mills.]

	GROSS TONS
Old iron rails	$12 00
Old steel rails	10 00
	NET TONS
No. 1 R. R. wrought scrap	$ 9 00
No. 1 wrought scrap	8 50
No. 1 Machine cast scrap	8 50
Iron axles	15 00
Axle turnings	8 00
Wrought turnings (free from cast)	6 50
Cast borings	4 75
Uncut wrought iron boilers	3 00
Steel boiler plates	8 00
Grate bars	4 00
Pipes and flues (clean)	7 00
Tank iron	6 00
Hoop and band iron	5 00
Sheet iron	5 00
Wrought drillings	6 00
Malleable iron	7 00

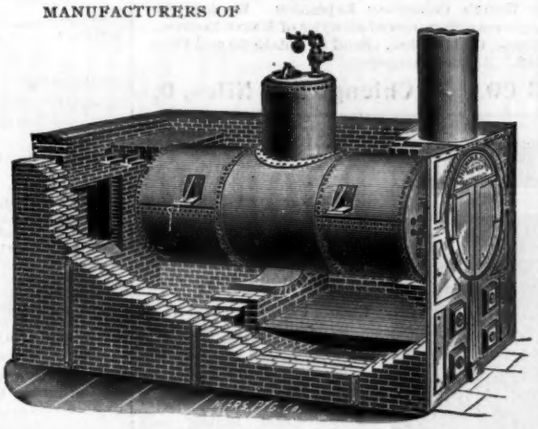
Frank P. Cady, Pres. and Supt.
Geo. H. Bowler, Sec'y and Treas.
THE CADY MFG. CO.
283 W. River St., CLEVELAND, O.

WIRE STRAIGHTENERS AND CUTTERS.
Power Presses, Dies, Drop Hammers, Punches and Shears, Special Machinery, Wire Forming Machines. . . . .

PERFORATED METALS
OF ALL KINDS FOR
MILLING MINING AND AGRICULTURAL MACHINERY,
PERFORATED IRON, STEEL, COPPER, BRASS, TIN, ZINC, LEAD, ETC., TO ORDER.
LARGE AND VARIED ASSORTMENT OF SIZES. CORRESPONDENCE SOLICITED.
THE ROBERT AITCHISON. PERFORATED METAL CO.,
OFFICE, ROOM 510 265 TO 269 DEARBORN STREET, CHICAGO, ILL. WORKS SOUTH CHICAGO.

Horse AND Mule Shoes
SHEETS, BARS, SLABS AND BILLETS.
Light Sheets for TINNING AND PERFORATING a Specialty.
Geo. H. Sibell & Co., 614-218 La Salle St., Chicago.

S. FREEMAN & SONS MFG. CO.,
11 BRIDGE ST., RACINE, WIS.
MANUFACTURERS OF
Standard Tubular, Fire Box, Vertical and Submerged Tube Steel
BOILERS
For Marine, Stationary, or Portable use.
ALSO OF
TANKS
OF ALL KINDS.
Smokestacks, etc., - - - - Grey Iron Castings.
Write for Prices and Terms.



DIXON'S PERFECT LUBRICATING GRAPHITE.
The most Marvelous Lubricant Known.
Used Dry, or Mixed with Water, Oil or Grease
NOT AFFECTED BY HEAT, COLD, STEAM OR ACIDS.
An Interesting and Instructive Pamphlet will be sent Free of Charge.
JOS. DIXON CRUCIBLE CO. Jersey City, N. J.

The Iron Trade Review
Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year **$3.00.**

IRON CLAD PAINT CO.
Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.
CLEVELAND, OHIO.

Trade Mark Patented.

ORDER DIRECT FROM THE
Iron Clad Paint Co.
And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.
IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.
FURNISHED both Dry and Ground in Oil
USED BY NEARLY ALL THE RAILROADS.

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. mill)	1.30c@1.40c
Angles	1.15c@1.20c
Tees	1.40c@1.50c
Universal Plates	1.25c
Sheared Plates	1.35c

MERCHANT IRON AND STEEL.

[List prices out of store.]

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 30
4¼ to 6 by ⅜ to 1 inch	1 35
1¾ to 6 by 1¼ to 2 inch	1 50
1¼ & 1⅜ by ⅜ to ¾ inch	1 35
1 & 1⅛ by ⅜ to ¾ inch	1 40
⅝, ⅜, ⅞, by ⅜ to ⅝ inch	1 50

Round and Square.

1 to 1⅞ inch	1 30
2 to 2⅝ inch	1 40
2¾ to 3¼ inch	1 55
3⅜ to 4 inch	1 80
4¼ to 4½ inch	2 40
4¾ to 5 inch	2 60

Oval.

⅞ to 1¼ inch	1 50
⅝ to ¾ inch	1 50
½	1 70
⅜	1 90

Half Oval and Half Round.

1¼ to 3 inch	1 85
⅞ to 1¼ inch	1 65
⅝ to ¾ inch	1 90
½	2 05
⅜	3 15

Heavy Band.

1¼ to 6 by ¼ and 5-16 inch	1 40
1 to 1⅜ by ¼ and 5-16 inch	1 45
¾ to ⅞ by ¼ and 5-16 inch	1 55
½ to ⅝ by ¼ and 5-16 inch	1 80

Hoop Iron.

1 7-16 to 4, No. 13, 14, 15 and 16	1 85
1 7-16 to 2, No. 17, 18 and 19	1 90
1 7-16 to 2, No. 20	2 00
1 7-16 to 2, No. 21	2 10
1 7-16 to 2, No. 22	2 20
1⅛ to 1⅜, No. 13, 14 and 15	1 90
1⅛ to 1⅜, No. 16, 17 and 18	1 95
1⅛ to 1⅜, No 19 and 20	2 00
1⅛ to 1⅜, No. 21	2 10
1⅛ to 1⅜, No. 22	2 20
15-16 and 1 inch, No. 13, 14 and 15	1 85
15-16 and 1 inch, No. 16, 17 and 18	2 00
15-16 and 1 inch, No. 19 and 20	2 10
15-16 and 1 inch, No. 21	2 20
15-16 and 1 inch, No. 22	2 30
⅞, No. 13, 14 and 15	2 10
⅞, No. 16, 17 and 18	2 20
⅞, No. 19 and 20	2 30
⅞, No. 21	2 40
⅞, No. 22	2 50
13-16, No. 13, 14 and 15	2 20
13-16, No. 16, 17 and 18	2 30
13-16, No. 19 and 20	2 40
13-16, No. 21	2 50
13-16, No. 22	2 60
¾, No. 13, 14 and 15	2 30
¾, No. 16, 17 and 18	2 45
¾, No. 19 and 20	2 55
¾, No. 21	2 65
¾, No. 22	2 75
11-16, No. 13, 14 and 15	2 55
11-16, No. 16, 17 and 18	2 60
11-16, No. 19 and 20	2 70
11-16, No. 21	2 80
11-16, No. 22	2 90
11-16, No. 23	3 00
⅝, No. 13, 14 and 15	2 60
⅝, No. 16, 17 and 18	2 70
⅝, No. 19 and 20	2 80
⅝, No. 21	2 90
⅝, No. 22	3 00
⅝, No. 23	3 10
9-16, No. 13, 14 and 15	2 80
9-16, No. 16, 17 and 18	2 90
9-16, No. and 20	3 00
9-16, No. 21	3 10
9-16, No. 22	3 20
9-16, No. 23	3 30
7-16 and ½ inch, No. 13, 14 and 15	3 00
7-16 and ½ inch, No. 16, 17 and 18	3 10
7-16 and ½ inch, No. 19 and 20	3 20
7-16 and ½ inch, No. 21	3 30
7-16 and ½ inch, No. 22	3 40
7-16 and ½ inch, No. 23	3 50
⅜, No. 13, 14 and 15	3 50
⅜, No. 16, 17 and 18	3 60
⅜, No. 19 and 20	3 70
⅜, No. 21	4 00
⅜, No. 22	4 10
⅜, No. 23	4 25

Light Band.

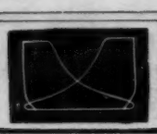
1½ to 6 by ⅛ to 3-16 inch	1 60
1½ to 6 by Nos. 11 and 12	1 65
1 to 1⅜ by ⅛ to 3-16 inch	1 65
1 to 1⅜ by Nos. 11 and 12	1 70
⅞ and 13-16 by ⅛ to 3-16 inch	1 80
⅞ and 13-16 by Nos. 11 and 12	1 85
¾ and 11-16 by ⅛ to 3-16 inch	1 90
¾ and 11-16 by Nos. 11 and 12	1 95
⅝ and 9-16 by ⅛ to 3-16 inch	2 05
⅝ and 9-16 by Nos. 11 and 12	2 10
½ by ⅛ to 3-16 inch	2 20
½ by Nos. 11 and 12	2 25

Wagon Box Iron.

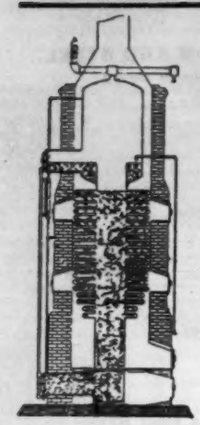
⅞ inch, beveled edge, by Nos. 11 and 12	1 80
⅞ inch, " " " " 13 and 14	1 90
¾ inch, " " " " 11 and 12	1 95
¾ inch, " " " " 13 and 14	2 15

Sheet Iron.

No. 10	1 85
No. 12	1 90
No. 14	1 95



MAKE YOURSELF A **Mechanical Engineer or Draughtsman;** or qualify to take charge of, or to superintend the manufacture of machinery by devoting your idle hours to **Home Study** by the method of **THE CORRESPONDENCE SCHOOL OF MECHANICS,** Scranton, Pa. To begin, students need only know how to read and write. Moderate Charges. Send for FREE Circular.



THE ADAMS

WATER TUBE BOILER.

This Boiler is absolutely safe from explosion. Gives as much steam from the waste heat as any boiler made. Easy of access for cleaning and repairs. Furnishes perfectly dry steam. Occupies little ground space. Economical in first cost. Send for complete circulars giving list of users and testimonials, one of which is printed below.

The Falcon Tin Plate & Sheet Co.,
NILES, O., Aug. 18, 1893.

Chas. P. Adams, Esq.

Dear Sir: The three boilers of 225 H. P. each which you furnished us are working in every way satisfactory. We consider them as good steamers as any we have ever used. Up to the present time have spent nothing on them for repairs. Very respectfully,

THE FALCON TIN PLATE & SHEET CO.,
By Warner Arms, Pres't.

C. P. ADAMS.

807 The Cuyahoga, - CLEVELAND. O.

EUREKA FENCE RATCHET.

SIMPLE, STRONG AND CONVENIENT TO HANDLE.

All parts held together by a pin inside of box; no losing of pawls or rollers. It can be adjusted quickly and be bought cheap. Both large and small sizes. Write for prices and terms. Address,

J. STAUFFER, 1630 East 3d St., Dayton, O.

WORLD'S FAIR AWARD.

We are the only Steel Roofing Co. awarded Medal and Diploma for **PATENT CAP ROOFING** at World's Columbian Exposition. We are also large manufacturers of all styles of METAL ROOFING, SIDING, CEILING, ETC. Send for Catalogue and Price List. Mention this paper.

SYKES IRON & STEEL ROOFING CO., - Chicago and Niles, O.

BEST AND CHEAPEST

ROOFING

For Iron Works, Foundries, Mills and Factories.

Elastic Paint for Metal Roofs and Siding only 60c. per gallon in bbls.

Send for Catalogue and references from hundreds of the largest Manufacturing firms in the United States. Also Water Proof Siding and Sheathing Paper.

Empire Paint & Roofing Co.,
111 N. Fourth St.,
PHILADELPHIA, PA.

STEEL CASTINGS

FROM 1 TO 40,000 POUNDS WEIGHT.
Of Open Hearth, Chester or Bessemer Steel.
True to Pattern. Sound. Solid.
GEARING OF ALL KINDS, CRANK SHAFTS, KNUCKLES FOR CAR COUPLERS.
Cross-Heads, Rockers, Piston Heads, etc., for Locomotives.
Steel Castings of every Description
CHESTER STEEL CASTINGS CO.,
WORKS: CHESTER, PA. OFFICE: 407 LIBRARY STREET. - PHILADELPHIA, PA.

C. W. HUNT COMPANY,

45 Broadway, New York,

MANUFACTURERS OF

Engineers' and Contractors' MACHINERY

For Hoisting and Conveying Purposes.

SECTIONAL TRACK, INDUSTRIAL AND CABLE RAILWAYS.
BARROWS, COAL BUCKETS, WIRE ROPE, TIP CARS, ETC.

Subscribe for THE IRON TRADE REVIEW; $3 00 per year.

No. 15-17	2 05
No 18	2 20
No. 20	2 30
No. 22-24	2 40
No. 25 26	2 50
No 27	2 60

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 60
Shell	1 85
Flange	2 10
Marine Flange	2 35
Fire Box	3 35

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. ₩ extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. ₩
1 to 2 in. inclusive	08
9-16 to ½ in. "	08½
7-16 to ⅜ and 2¾ to 3 in	09
3⅛ to 4 in	09½
⅜ to 11-16 and 4½	10
⅝ to 6 in	10½
¾ to 9-32 and 6¼ to 7 in	11
3-16 in	13

Flats.

	cts. ₩
2 to 9-16 in. wide by 2 to ⅝ thick	8

Bessemer and O. H. Steel.

Machinery	base price,	1 80
Tire	"	1 85
Spring	"	2 20
Sleigh Shoe	"	2 20
Toe Calk	"	2 05
Cutter Shoes, tapered and bent	"	2 45

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 70
Bridge ½, ⅝, 11-16 and ¾ inch diam	3 40

MACHINERY SUPPLY MARKET.

Anvils.

American	₩ lb 9@10
Wright's	₩ lb 12

Bellows.

Blacksmiths'	Hill's	dis 40
	Bullock's	dis 50&10
Moulders'		dis 40@40&10
Hand		dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single,	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 5c&5
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis 45

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.,	dis 35
Buffalo	dis 40

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis 35
Horton's Universal	dis 40
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 20

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis 15
" " Gear Cutters	dis 15

Crowbars.

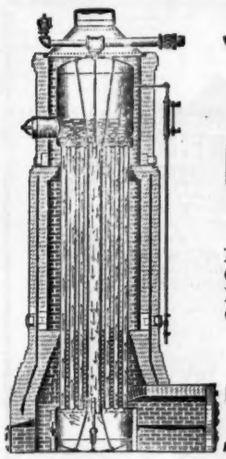
Cast Steel	₩ 3½
Iron, steel points	₩ lb 3

Drill and Drill Sockets.

Twist Drills	dis 50&10
Morse Taper and Straight Shank to 1⅛"	dis 50&10
Morse Taper and Straight Shank Larger than 1⅛"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 55@55&5
Cleveland " "	dis 55@55&5

Emery.

	No. 4 to No. 54		
	46 gr.	150 gr.	F. FF.
Kegs, ₩ lb	4½c	5 c	2½c
½ kegs ₩ lb	4¾c	5¼c	2¾c
¼ kegs ₩ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6¼c	5 c
10 lb cans less than 10	10 c	10 c	7½c



J. C. McNEIL CO.,

AKRON, OHIO,

SOLE BUILDERS OF THE

Cook Patent Water Tube Boiler

THE ONLY PERFECT WASTE-HEAT BOILER.

No incrustation.
Generates the greatest amount steam with least amount heat.
Repairs reduced to a minimum.
Can be used equally as well for direct firing or with natural gas.

WE ARE ALSO BUILDERS OF

HORIZONTAL, TUBULAR, AND FLUE BOILERS, OIL TANKS AND WATER STAND PIPES.

☞Estimates furnished promptly on receipt of specifications.

FRANK R. BIEDLER,

(PRINCIPAL)
Baltimore Offices,
Equitable Building,

(BRANCH)
New York Offices
Welles Building,
18 Broadway.

MINING MINERAL AND TIMBER LANDS.

Municipal Bonds,
Farm and City Mortgages,
Short Time Paper.

Large Tracts of Florida
Phosphate and
Hammock Lands.

EXAMINATIONS AND REPORTS MADE.

☞Correspondence Solicited.

Moffet Portable Drill

UNSURPASSED AS A REAMER.

Weighs 48 pounds and drills from ⅜ to 2 inches diameter.

Runs with Steam or Compressed air.
Will Work in Any Position.
An Economical Substitute for Rachet Drilling.
Send for Circular.

MANUFACTURED BY

J. G. TIMOLAT

89 and 91 S. Fifth Ave., NEW YORK.

"Better Than Any Other."

That's what the Gobeille Pattern Co. says of our **BRASS DOWELS** for patterns and core-boxes.

Over **500** shops are using them.

SAMPLES and price-list **FREE.**

TIMMIS & CLISSOLD, Bound Brook, N. J.

Also Rapping Plates, Peg and Cup Brass Dowels, Metallic Pattern Letters, Metallic Fillet, Forstner Bits, Steel Tapes, etc.

A. H. LEITCH, PRES JOHN C. LEITCH, SEC. AND GENL. MAN. JOHN A. WILSON, TREAS.

WESTMORELAND FIRE BRICK CO

MANUFACTURERS OF HIGH GRADE FIRE BRICKS

PITTSBURG, PA.

Works and Mines, Westmoreland, Pa.

FOR SALE!

A new IRON BUILDING for immediate shipment, 81 ft. wide, 200 ft. long, consisting of a main span 61 ft wide, with lean-to on one side 20 ft. wide.

The trusses are sufficiently strong to carry a line of shafting and light jib crane. This building is suitable for a Machine Shop, Tin Plate Mill, Rolling Mill, etc.

For further information, address
SHIFFLER BRIDGE CO., Pittsburg, Pa.

WELL DRILLING MACHINERY,
MANUFACTURED BY
WILLIAMS BROTHERS,
ITHACA, N.Y.
MOUNTED OR ON SILLS, FOR DEEP OR SHALLOW WELLS, WITH STEAM OR HORSE POWER
SEND FOR CATALOGUE
ADDRESS WILLIAMS BROS. ITHACA, N.Y.

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 50@50&5
H. H. Barton.....dis 50@50&5

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Sterling.....dis 60
Celluloid.....dis 10&33⅓
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 60&10
Hamden.....dis 60&10@70
Cyclone.....dis 60@60&10

Files.

Arcade.....dis 60&10@60&10&10
Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
McClellan.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50
Industry File Works Hand Cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs.....15c
" " " over 5 lbs.....12c

Jack Screws.

Illinois Bolt Co. list.....dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¾	4	3¾	3½
Hexagon	15½	11½	8½	6	5¾	5¼	
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ₱ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

List July 14, 1887.....dis 85
Standard Penny Nails, ₱ keg card rate
Car lots.....$1.20
Less than car lots...$1.35

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₱ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₱ lb 9@10
Russia " " .....₱ lb 14
Italian " " .....₱ lb 13@19
Plumbago Piston.....₱ lb 40
Peerless.....₱ lb 60
Morrison's " .....₱ lb 45
Square Flax " .....₱ lb 50
Sheet Rubber.....₱ lb 12&24
Excelsior Rubber.....₱ lb 48
Rainbow.....Full Rolls.....45c ₱ lb; Less than Full Rolls, 50c ₱ lb
Eclipse Gasket.....₱ lb 75

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 50
Medart Pulleys.....dis 50
Split Wood Pulleys.....dis 55@60

Rivets.

Iron, Thousand, list November 17.....dis 50&10@60
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50&10@60
Copper.....dis 50@50&10

Saws.

Disston's Circular.....dis 40&10
" Band.....dis 25
" Scroll.....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Diston's.....dis 30
Atkins' Circular Saws.....dis 40&25
" Mill, Mulay and Drag Saws.....dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....70c per ft
" Dexter Cross-cuts.....50c "
" Diamond " .....30c "
" Tuttle Tooth Cross-cuts.....25c "
" One-man Cross-cuts.....32c "
No. 1 Handles.....23c per pair
No. 6 " .....16c "
Excelsior Saw Tools.....$6 per doz
Derfection " .....$15 "
Petroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay.....dis 45

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list.....dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 55
Pulley Taps.....dis 40

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 15@20
Howard.....dis 35

Wire.

New List, Jan. 18, 1884

Brass	dis 30
Copper	dis 40
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis65& 5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	95c ℔ D dis 30

Wrenches.

Coe's genuine	dis 50
Girard Standard	dis 70&10
Agricultural	dis 75&10
Mechanic's	dis 55&10& 5
Bemis & Call's Combination	dis 35
Donohue's Engineers	dis 20&10
Lamson & Sessions Engineers	dis 60
Billings & Spencer's Drop Forged	dis 25
William's " "	dis 25
Alligator " "	dis 40

Bolt and Nut Works.

THE UPSON NUT CO., Manufacturers of Nuts, Washers, Carriage, Machine, Plow and Elevator Bolts, Coach Screws, etc.

Steel Stamps and Stencils.

FLEHARTY, J. H. & Co., Rubber Stampes Seals, Stencils, Automatic Check Punchs, and Numbering Machines. 92 Seneca St.

E. C. POPE,

COMMISSION DEALER IN

Iron Ore, Pig Iron

AND METALS.

Cleveland, - Ohio.

ESTABLISHED 1854.

PETER GERLACH & CO.,

MAKERS OF

Saws, Tools and Machinery.

Office and Warerooms, 28 Columbus St.

Factories on Columbus, Winter and Leonard Sts

Cleveland, Ohio, U. S. A.

THE CONDIT-FULLER CO.,

Pig and Bar Iron,

CLEVELAND, . OHIO.

Oglebay, Norton & Co..

Successors to Tuttle, Oglebay & Co.

Commission Dealers in

IRON ORES,

FROM MARQUETTE, GOGEBIC AND MENOMINEE DISTRICTS.

CLEVELAND, OHIO.

J. H. OUTHWAITE. W. G. POLLOCK.

J. H. OUTHWAITE & CO.,

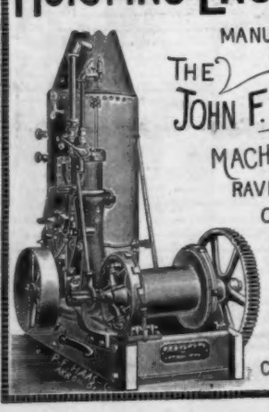
Exclusive attention given to

LAKE SUPERIOR AND MENOMINEE RANGE

IRON ORE.

Perry-Payne B'ld'g. - Cleveland, O.

HOISTING ENGINES



MANUF'D BY

THE JOHN F. BYERS MACHINE CO., RAVENNA, OHIO.

WRITE FOR CATALOGUE.

STEEL, IRON, COPPER, ZINC, BRASS, TIN,

And all Other Metals Perforated as Required for

GRAIN CLEANING AND MINING MACHINERY,
WOOLEN, COTTON, PAPER AND PULP MILLS,
RICE, FLOUR AND COTTON SEED OIL MILLS,
SUGAR AND MALT HOUSES, DISTILLERIES, FILTER PRESSES,
STONE, COAL AND ORE SCREENS,
BRICK AND TILE WORKS, FILTERS,
SPARK ARRESTERS, GAS AND WATER WORKS,
OIL, GAS AND VAPOR STOVES,
COFFEE MACHINERY, ETC., ETC.

STANDARD SIZES PERFORATED TIN AND BRASS ALWAYS IN STOCK.

THE HARRINGTON & KING PERF. CO.,

Main Office and Works, 222 to 240 N. Union St., Chicago, Ill., U. S. A.

Eastern Office, No. 284 Pearl St., New York.

WILLIAM TOD & CO.

YOUNGSTOWN, OHIO.

THE PORTER-HAMILTON ENGINE

SINGLE, COMPOUND & CONDENSING

Blowing Engines.

Hydraulic Cranes and Accumulators.

Heavy Special Machinery.

ENGINE CATALOGUE ON APPLICATION.

THE LLOYD-BOOTH CO., YOUNGSTOWN, OHIO.

Tinning MACHINERY

Rolling Mills, Sand and Chill ROLLS.

POWER From **GAS OR GASOLINE.**

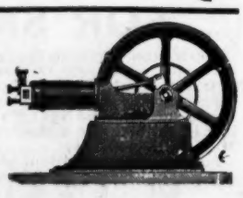
No Steam, Coal, Ash, Gauges, Engineer nor Danger.

From 1 to 100 horse-power. } **Can be Used in City or Country.**

In conjunction with our Producer Gas Apparatus, we guarantee coal consumption of 1½ pounds per hour per h.p.

OTTO GAS ENGINE WORKS., 33rd & Walnut Sts. PHILADELPHIA, PA.

S. M. York, 42 S. Water St., Cleveland Agent.

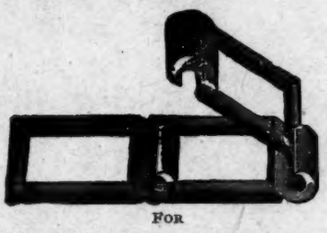


JEFFREY

Chain Belting

—ALSO—

MALLEABLE, STEEL, WROUGHT AND SPECIAL CHAINS.



FOR

ELEVATING AND CONVEYING MACHINERY

Send for Illustrated Catalogue.

REDUCED PRICE LIST.

THE JEFFREY MFG CO.

143 E. First Ave., Columbus, O.
New York Branch, 163 Washington St.

FOR SALE

In Florida,

Several thousand acres of the choicest orange and vegetable lands, including some of the most valuable muck beds and beautiful lakes in the States, all situated within three miles of railroad station.

THESE LANDS WILL BE SOLD TO ACTUAL SETTLERS

At prices defying competition.

I have large tracts from 200 to 5,000 acres, grazing, farm, garden and orange lands, also several valuable phosphate beds near Dunnellon and Anthony, Marion County. Address

FRANK R. BIEDLER, BALTIMORE, MD.

RICHARD A. PARKER., C. E.,

Consulting Mining Engineer.

—SPECIALTIES—

Iron, Gold and Silver Mining.

Offices: { 100 W. Washington St., CHICAGO. / MARQUETTE, MICH.

$2.50 CLEVELAND TO BUFFALO.

VIA "C. & B. LINE."

Commencing with opening of navigation (about April 1st.) Magnificent side-wheel steel steamers

"State of Ohio" and "State of New York."

DAILY TIME TABLE.

SUNDAY INCLUDED.

Lv. Cleveland, 6:15 P. M. | Lv. Buffalo - 6:15 P. M.
Ar. Buffalo, - 7:30 A. M. | Ar. Cleveland, 7:30 A. M.

CENTRAL STANDARD TIME.

Take the "C. & B. Line" steamers and enjoy a refreshing night's rest when en route to Buffalo, Niagara Falls, Toronto, New York, Boston, Albany, 1,000 Islands, or any Eastern or Canadian point.

Cheap Excursions Weekly to Niagara Falls.

Write for Tourist Pamphlet.

H. R. ROGERS, Gen'l Pass. Agt., Cleveland, O.
T. F. NEWMAN, Gen'l Manager.

VERTICAL

Balanced Compound Engines

FOR

ROLLING MILLS AND BLAST FURNACES,

Direct Connections.

Any variations of speed desired. Guaranteed more economical, powerful and durable than any type of engine in use.

WELLS ENGINE CO.,

91 Liberty St., New York City.

THE GREINER ECONOMICAL CUPOLA.

Cupolas Built or System Applied to any Cupola.

15 Per Cent Saving in Fuel Guaranteed.

Over 500 in Use.

WRITE

The GREINER ECONOMICAL CUPOLA CO.,

714 Bort Building, Chicago.

THE TOLEDO MACHINE & TOOL CO.

501-505 Superior St.. Toledo, Ohio.

We manufacture

No. 3 Power Press.

Power Punches, Forging Presses,
Power Presses, Trimming Presses,
Straight Sided Double Pitman Presses,
Drop Presses,
Embossing Presses, Automatic Feed Presses,
Stamping Presses, Power Slitting Machines,
Riveting Machines, Power Shears.

Special and Automatic Machinery Dies for all classes of work in sheet metals,

Write for catalogue and prices.

No. 25 Power Press

FUEL OIL BURNERS.

J. R. Armstrong's System of Burning

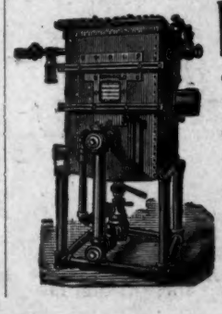
Crude Petroleum.

WHY IT IS THE BEST.

Send for Catalogue.

JOHN R. ARMSTRONG COMPANY,

35 West Monroe St., Chicago, Ill.



350,000 HORSE-POWER

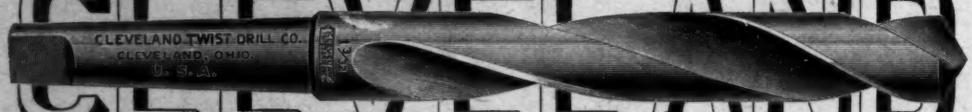
of our ***Vacuum Feed Water Heaters and Purifiers*** *could not have been installed unless the constant investigations had clearly demonstrated their saving capabilities. Our Catalogue will fully enlighten you, and will be sent if desired. We also build the Webster Separator and Williames Vacuum System of Steam Heating.*

WARREN WEBSTER & CO.,

NEW YORK, 126 Liberty Street.
CHICAGO, Monadnock Building.

No. 1. CAMDEN, N. J.

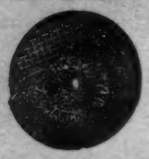
CLEVELAND



1874—OLD (SEND FOR CATALOGUE. WRITE FOR DISCOUNT.) RELIABLE—1894

THE HART OR DETROIT

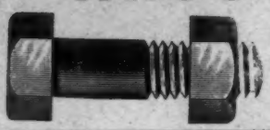
Emery Corundum Wheels and Machinery.



Write to J. WENDELL COLE, M. E.,
District Manager, Box 152, Chicago, Ill., or Box 84, Columbus, O.

☞ N. B.—Also Agent for WM. SELLERS & CO.'s SPECIAL TOOL GRINDER and TWIST DRILL GRINDER WITH POINTER, for Pennsylvania, Ohio, Indiana, Illinois and Wisconsin.

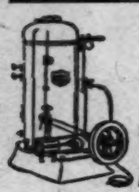
WROUGHT WASHERS,



MACHINE BOLTS, HOT PRESSED NUTS,

HIGHEST STANDARD OF EXCELLENCE.

The MILTON MFG. CO., MILTON, PA.



5 Horse Power Engine and Boiler $165

SAW MILL ENGINE AND BOILER. $450.

Other sizes in Proportion.
Engines and Boilers 2 to 500 H. P.
For Circulars address
Armstrong Bros., Springfield, O.

JAS. MURDOCK, JR.,

MANUFACTURER OF

Steel Stamps, Alphabets and Figures, Time and Tool Room Checks, Sheet Metal Stamped Goods.

52-60 Longworth Street,
CINCINNATI, O.

E. H. JONES & CO.,

ENGINEERS & CONTRACTORS. 54 Frankfort St., Cleveland, O.

Steam Plant Complete. Engines, Boilers, Pumps, Heaters, Etc.
Steam and Hot Water Heating.

STURTEVANT'S BLOWER, COILS, Etc., for Hot Blast Heating.

Awarded the GRAND PRIZE at the Paris Exhibition.

SEND FOR THIS BOOK
FREE ON APPLICATION.
THE BABCOCK & WILCOX CO
30 CORTLANDT ST. N.Y.
WATER TUBE
STEAM BOILERS
BRANCH OFFICES
BOSTON, MASS. 8 OLIVER ST.
PHILADELPHIA, PA. 32 N. 5TH ST.
PITTSBURGH, PA. 408 LEWIS BLOCK.
CLEVELAND, O. 412 PERRY-PAYNE BG
CHICAGO, ILL. 45 S. JEFFERSON ST.
MINNEAPOLIS, MINN. 604 CORN EX.
NEW ORLEANS, LA. 57 CARONDELET ST.
HAVANA, CUBA. 116½ CALLE DE LA HABANA.
MANUFACTORIES IN UNITED STATES, SCOTLAND, FRANCE, GERMANY & AUSTRIA.

Cleveland Office, 412 Perry-Payne Building, Cleveland, O.

ASPHALT SEAMLESS ROOFING

The maximum results with a minimum expense, with complete adaptability for the highest structural requirements.
Manufactured by

Consolidated Roofing Works, Columbus, O.

M. H. CRITTENDEN & SON, Minneapolis, Minn. | MILLER OIL CO., Indianapolis, Ind. | H. M. REYNOLDS & SON, Grand Rapids, Mich

CLEVELAND ROLLING MILL CO.,

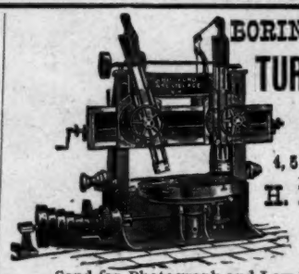
CLEVELAND, - OHIO,

—MANUFACTURERS OF—

BESSEMER AND OPEN-HEARTH STEEL,

Blooms, Billets, and Slabs, Steel Rails, Steel Beams, Channels and Angles. Steel Forgings, Bar Spring, and Sleigh Shoe Steel. Steel Wire of all kinds. Barbed Wire, Iron and Steel Plates, Galvanized and Black Sheet Iron and Steel Corrugated Iron Roofing.

BORING AND TURNING MILLS,



4, 5 & 6 Ft. Swing.

H. Bickford,
Lakeport,
N. H.

Send for Photograph and Low Price.

M. V. SMITH, Pres. C. C. MORROW, Sec.
M. A. GREEN, V. Pres JOHN A. ELLIOTT, Treas

ARTIFICIAL GAS ENGINEERING COMPANY,

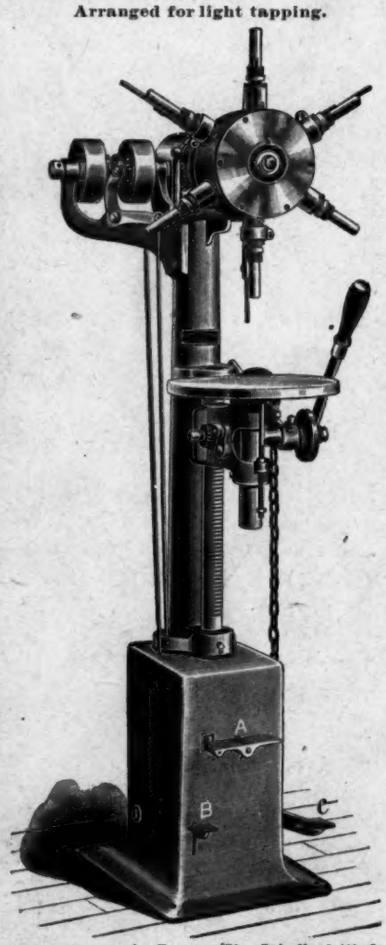
Consulting and Contracting Engineers,

706 Times Bldg., PITTSBURG, PA.

ARTIFICIAL GAS applied to all branches of manufacturing and domestic uses. Apparatus for the manufacture of coal-gas furnished at lowest prices.

QUINT'S TURRET DRILLS,

Arranged for light tapping.



A sensitive and effective *Six Spindle* drill for drilling from 0 to ½ in. Only the spindle in use revolves. All holes drilled in centre of table. All independent drill stop for each spindle. Speed from 250 to 2,000 rev. Send for circular. Address
A. P. QUINT, Hartford, Conn.

Subscribe for The IRON TRADE REVIEW.